# DATA COLLECTION SURVEY
# ON
# ASEAN REGIONAL COLLABORATION
# IN
# DISASTER MANAGEMENT

# FINAL REPORT
# COUNTRY REPORT
# PHILIPPINES

**DECEMBER 2012**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

**NIPPON KOEI CO., LTD.**
**ALMEC CORPORATION**
**MITSUBISHI RESEARCH INSTITUTE, INC.**

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# List of Abbreviations and Acronyms

**A**

| | | |
|---|---|---|
| AADMER | : | ASEAN Agreement on Disaster Management and Emergency Response |
| AASHTO | : | American Association of State Highway and Transportation Officials |
| ACDM | : | ASEAN Committee for Disaster Management |
| ADMIS | : | ASEAN Disaster Management Information System |
| ADRC | : | Asian Disaster Reduction Centre |
| AHA Center | : | ASEAN Coordination Center for Humanitarian Assistance on Disaster Management |
| ASEAN | : | Association of South East Asian Nations |
| AusAID | : | Australian Agency for International Development |
| **B** | | |
| BCP | : | Business Continuity Plan |
| BDMS | : | Brunei Darussalam Meteorological Service |
| BDRRMC | : | Barangay Disaster Risk Reduction Management Council |
| BMKG | : | Badan Meteorologi, Klimatologi, dan Geofisika (Meteorological, Climatological and Geophysical Agency) |
| BPBD | : | Badan Penanggulangan Bencana Daerah (Regional Disaster Management Agency) |
| **C** | | |
| CBDRM | : | Community-Based Disaster Risk Management |
| CCA | : | Climate Change Adaptation |
| CCFSC | : | Central Committee for Flood and Storm Control |
| CRED | : | Center for Research on the Epidemiology of Disasters |
| CVGHM | : | Centre for Volcanology and Geological Hazard Mitigation |
| **D** | | |
| DDMFSC | : | Department of Dyke Management, Flood and Storm Control |
| DDMRC | : | District Disaster Management and Relief Committee |
| DID | : | Department of Irrigation and Drainage |
| DKI | : | Daerah Khusus Ibukota (Special Capital Territory) |
| DMH | : | Department of Meteorology and Hydrology |
| DMIS | : | Disaster Management Information System |
| DND | : | Department of National Defence |
| DOST | : | Department of Science and Technology |
| DPWH | : | Department of Public Works and Highways |
| DREAM | : | Disaster Risk Exposure and Assessment for Mitigation |
| DRR | : | Disaster Risk Reduction |
| **E** | | |
| EM-DAT | : | Emergency Disaster Database |
| EOC | : | Emergency Operations Center |
| EOS | : | Emergency Operating System |
| EWS | : | Early Warning System |
| **F** | | |
| FCIC | : | Flood Control Information Center |
| FFWS | : | Flood Forecasting and Warning System |
| **G** | | |

| | | |
|---|---|---|
| GDP | : | Gross Domestic Product |
| GIS | : | Geographic Information System |
| GLIDE | : | GLobal IDEntifier Number |
| GPS | : | Global Positioning System |
| GTS | : | Global Telecommunication System |
| **H** | | |
| HFA | : | Hyogo Framework for Actions |
| HMD | : | Hydro- Meteorological Division |
| **I** | | |
| ICHARM | : | International Centre for Water Hazard and Risk Management |
| I-DRMP | : | Integrated Disaster Risk Management Plan |
| InaTEWS | : | Indonesia Tsunami Early Warning System |
| INGO | : | International Non-government Organisation |
| **J, K** | | |
| JICA | : | Japan International Cooperation Agency |
| JMA | : | Japan Meteorological Agency |
| JMG | : | Minerals and Geoscience Department Malaysia |
| KOICA | : | Korea International Cooperation Agency |
| **L** | | |
| Lao PDR | : | Lao People's Democratic Republic |
| LCD | : | Liquid Crystal Display |
| LDRRMC | : | Local Disaster Risk Reduction and Management Council |
| LDRRMF | : | Local Disaster Risk Reduction and Management Fund |
| LGU | : | Local Government Units |
| LIPI | : | National Institute of Science |
| **M** | | |
| MES | : | Myanmar Engineering Society |
| MGB | : | Mines and Geosciences Bureau |
| MGS | : | Myanmar Geosciences Society |
| MMDA | : | Metro Manila Development Authority |
| MPWT | : | Ministry of Public Works and Transportation |
| **N** | | |
| NAMRIA | : | National Mapping and Resource Information Authority |
| NDMC | : | National Disaster Management Center |
| NDMC | : | National Disaster Management Committee |
| NDRRMC | : | National Disaster Risk Reduction and Management Council |
| NDRRMP | : | National Disaster Risk Reduction and Management Plan |
| NFP | : | National Focal Point |
| NGO | : | Non-governmental Organization |
| NOAA | : | National Oceanic and Atmospheric Administration |
| **O** | | |
| OCD | : | Office of Civil Defence |
| OFDA | : | Office of Foreign Disaster Assistance |
| **P** | | |
| PAGASA | : | Philippine Atmospheric, Geophysical and Astronomical Services Administration |
| PCIEERD | : | Philippine Council for Industry, Energy and Emerging Technology Research and Development |

| | | |
|---|---|---|
| PHIVOLCS | : | Philippine Institute of Volcanology and Seismology |
| PIA | : | Philippine Information Agency |
| PTWC | : | Pacific Tsunami Warning Center |
| **R** | | |
| RDRRMC | : | Regional Disaster Risk Reduction Management Council |
| READY | : | Hazards Mapping and Assessment for Effective Community-Based Disaster Risk Management |
| REDAS | : | Rapid Earthquake Damage Assessment System |
| **S, T** | | |
| SATREPS | : | Science and Technology Research Partnership for Sustainable Development |
| SNS | : | Social Networking Service |
| SOP | : | Standard Operating Procedure |
| TMD | : | Thai Meteorological Department |
| **U~** | | |
| UN | : | United Nation |
| UNDP | : | United Nations Development Programme |
| UNHCR | : | United Nations High Commissioner for Refugees |
| USGS | : | United States Geological Survey |
| VSAT | : | Very Small Aperture Terminal |
| YCDC | : | Yangon City Development Committee |

## Abbreviations of Measures

### Length

| | | |
|---|---|---|
| mm | = | millimeter |
| cm | = | centimeter |
| m | = | meter |
| km | = | kilometer |

### Area

| | | |
|---|---|---|
| ha | = | hectare |
| $m^2$ | = | square meter |
| $km^2$ | = | square kilometer |

### Volume

| | | |
|---|---|---|
| 1, lit | = | liter |
| $m^3$ | = | cubic meter |
| $m^3$/s, cms | = | cubic meter per second |
| MCM | = | million cubic meter |
| $m^3$/d, cmd | = | cubic meter per day |

### Weight

| | | |
|---|---|---|
| mg | = | milligram |
| g | = | gram |
| kg | = | kilogram |
| t | = | ton |
| MT | = | metric ton |

### Time

| | | |
|---|---|---|
| sec | = | second |
| hr | = | hour |
| d | = | day |
| yr | = | year |

### Money

| | | |
|---|---|---|
| BND | = | Brunei Dollar |
| KHR | = | Cambodian Riel |
| IDR | = | Indonesian Rupiah |
| LAK | = | Lao Kip |
| MMK | = | Myanmar Kyat |
| MYR | = | Malaysian Ringgit |
| PHP | = | Philippine Peso |
| SGD | = | Singapore Dollar |
| THB | = | Thai Baht |
| USD | = | U.S. Dollar |
| VND | = | Vietnamese Dong |

### Energy

| | | |
|---|---|---|
| Kcal | = | Kilocalorie |
| KW | = | kilowatt |
| MW | = | megawatt |
| KWh | = | kilowatt-hour |
| GWh | = | gigawatt-hour |

### Others

| | | |
|---|---|---|
| % | = | percent |
| o | = | degree |
| ' | = | minute |
| " | = | second |
| °C | = | degree Celsius |
| cap. | = | capital |
| LU | = | livestock unit |
| md | = | man-day |
| mil. | = | million |
| no. | = | number |
| pers. | = | person |
| mmho | = | micromho |
| ppm | = | parts per million |
| ppb | = | parts per billion |
| lpcd | = | litter per capita per day |
| Mw | = | moment magnitude scale |

# Exchange Rate

| **Exchange Rate** | | | **August 18, 2012** |
|---|---|---|---|
| Country | Currency | | Exchange rate to USD (1USD=79.55JPY) |
| Brunei | BND | Brunei Dollar | 1.2538 |
| Cambodia | KHR | Cambodian Riel | 4,068 |
| Indonesia | IDR | Indonesian Rupiah | 9,490 |
| Lao PDR | LAK | Lao Kip | 7,982.5 |
| Malaysia | MYR | Malaysian Ringgit | 3.1315 |
| Myanmar | MMK | Myanmar Kyat | 875.5 |
| Philippines | PHP | Philippine Peso | 42.4 |
| Singapore | SGD | Singapore Dollar | 1.2538 |
| Thailand | THB | Thai Baht | 31.51 |
| Vietnam | VND | Vietnamese Dong | 20,845 |

# DATA COLLECTION SURVEY ON ASEAN REGIONAL COLLABORATION IN DISASTER MANAGEMENT

## FINAL REPORT

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**Abbreviation**

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# CHAPTER 1 INTRODUCTION

## 1.1 Background of the Survey

Frequency of natural disasters has been increasing for last 30 years in the world, having caused great damages/losses. Among those damages/losses, about 90 % are concentrated in the Asian region where natural disasters are one of the serious issues not only for humanitarian but also for economic and industrial point of view.

## 1.2 AADMER, HFA and AADMER Work Program

Under such circumstance, the ASEAN 10 countries had reached an agreement of "the ASEAN Agreement on Disaster Management and Emergency Response (AADMER)" on 26th July, 2005 (ratified on 24th December, 2009); in order to strengthen the disaster management structure in the region for the implementation of the Hyogo Framework for Actions (HFA) 2005-2015.

In relation to those activities above, the ASEAN Committee for Disaster Management (ACDM) adopted "AADMER Work Program 2010-2015" as the guideline of the activities for the AADMER, at its 15th Meeting of March, 2010 held in Singapore.

## 1.3 AHA Centre

At the same time, the ASEAN countries recognized the necessity to establish "the ASEAN Coordination Centre for Humanitarian Assistance on Disaster Management (AHA Centre)" and set up as a provisional status in Jakarta, Indonesia in October, 2007.

As the first phase of the AADMER Work Program 2010-2015, the AHA Centre has formally been established in November 2011 at the ASEAN Summit Meeting in Bali, Indonesia; and to be ratified in due course. The AHA Centre has started various activities with such assistance as procurement of facilities/equipment, provision of technical supports and so on from donors including Japan.

## 1.4 Cooperation between ASEAN and Japan

On the other hand, it was re-affirmed that Japan and the ASEAN would continue the mutual cooperation in the field of disaster management, at the Special Japan-ASEAN Ministerial Meeting in Jakarta on April 9, 2011 held soon after the Great East Japan Great Earthquake; at the ASEAN Post Ministerial Conference of July 21, 2011; and at the Japan-ASEAN Summit on November 18, 2011. At the meeting/conference, Japan has expressed its commitment to support the activities of AHA Centre not only directly to the Centre but also through bi-lateral cooperation with each ASEAN country for the regional natural disaster management.

## 1.5 Data Collection Survey

The activities of the AHA Centre have just started and therefore they do not have much information even fundamental on natural disasters and disaster management of the ASEAN countries.

Japan International Cooperation Agency (JICA) has therefore decided to conduct "the Data Collection Survey on ASEAN Regional Collaboration in Disaster Management" for considerations of future plans of assistances to the AHA Centre and each ASEAN country in the field of natural disaster management.

## 1.6 Purposes of the Survey

The purposes of the survey are as follows:

- To collect basic information on disaster management of the ASEAN counties;
- To conduct needs and potential assessment for development of disaster management in the ASEAN region; and,
- To propose an ASEAN guideline/reference for flood risk assessment.

## 1.7 Outputs to Be Expected

- Inventory of information on disaster management of each ASEAN country;
- List of programs/projects/schemes for future assistances for disaster management;
  - Bi-lateral assistance;
  - Regional assistance;
- ASEAN guideline/reference for flood risk assessment.

This report presents the country report of Philippines. The full reports for the study were prepared separately as Main Report.

# CHAPTER 2 HAZARD PROFILE

## 2.1 Introduction

The ASEAN countries are geographically located in Southeast Asia and north of Australia continent. The region is generally in areas of a tropical hot and humid climate zone the exception of the north-western part that experiences a humid sub-tropical climate. The region receives plentiful rainfall and remains humid in years. Generally, the countries have a dry and wet season due to seasonal shifts in monsoon, while the mountainous areas in the northern part have a milder and drier climate at high attitude.

The ASEAN region is geographically diverse and includes high hills and rugged mountains, elevated plateaus, highlands, floodplains, coastal plains and deltas underlined by various types of geology. The region is also home to large river systems such as the Mekong and Ayeyarwady River, and major water bodies as the Tonle Sap and Lake Tobe. There are several tectonic plates in the region that have cause earthquakes, volcanic eruptions and tsunamis; also locate the two great oceans of the Pacific and the Indians that are origins of seasonal typhoons or cyclones and tsunami. All these natural set-up are the background of a history of devastating disasters of various types that have caused economic and human losses across the regions.

Hereafter Chapter 2 describes an overview of disasters for the past 32 years from 1980 to 2011 based mainly on the data from "EM-DAT: The OFDA/CRED International Disaster Database: www.emdat.be - Université Catholique de Louvain - Brussels – Belgium.[1]" "Criteria and definitions" by EM-DAT; and the full set of data used this chapter are shown in Chapter 2.4.

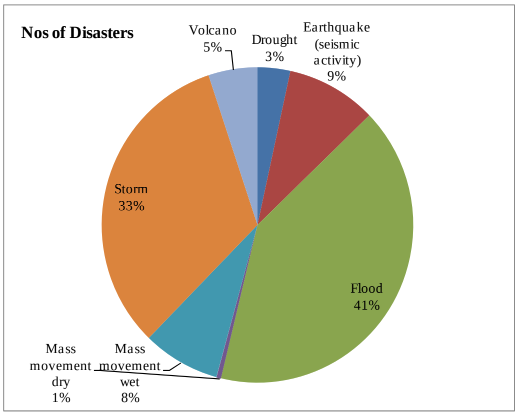
The Team notes that there are such issues in EM-DAT to be improved/ clarified that definitions of some hazards including multi-hazard are unclear, disasters of small scales are not, so on. However, this data base is considered useful when outlines of disasters among different states are compared on a same assumption. The Team presents this chapter with intention that ASEAN states may share the knowledge of disasters in neighboring states and that the states may re-recognize that a data base on the basis of the unified ASEAN criteria, instead of EM-DAT, should be needed for detail analysis/understanding of disasters in the ASEAN region.

[1] Among the data set categorized as natural disaster in EM-DAT, "epidemic", "insect infestation" and "wildfire" are not included in this survey.

## 2.2 Natural Disasters in the ASEAN Region

**Number of Natural Disasters:**

Figure 2.2.1 shows that in 1980-2011, 41% of the total number of disasters in the ASEAN region was due to flooding, followed by storms (33%). 'Storms[2]' and 'floods' (water related hazard totaling to about 74%) are the most frequent hazards in the region. It may be noted that the 'mass movement' has similar frequency as the earthquake, implying that mass movement/sediment disasters may not be negligible in the ASEAN region.




| Disasters from 1980 to 2011 | Nos of Disasters | % |
|---|---|---|
| Drought | 36 | 3.4% |
| Earthquake (seismic activity) | 99 | 9.4% |
| Flood | 433 | 41.0% |
| Mass movement dry | 5 | 0.5% |
| Mass movement wet | 85 | 8.0% |
| Storm | 344 | 32.6% |
| Volcano | 54 | 5.1% |
| Total | 1,056 | 100.0% |

Data from 1980 to 2011
Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

**Figure 2.2.1 Nos. of Natural Disasters in ASEAN Region (1980-2011)**

**Total Number of Affected People:**

Figure 2.2.2 shows the total number of affected people. About 47% of the total number of people was affected due to 'storm' followed by 'flood' (33%). Water related hazards totaled to 80% and have significant impact on the people in the ASEAN region (Figure 2.2.2 above). On the other hand, 'drought' affects a large number of people per event followed by 'storm' and 'flood' (Figure 2.2.2 below), implying that 'drought' prevails in wider areas of the region.

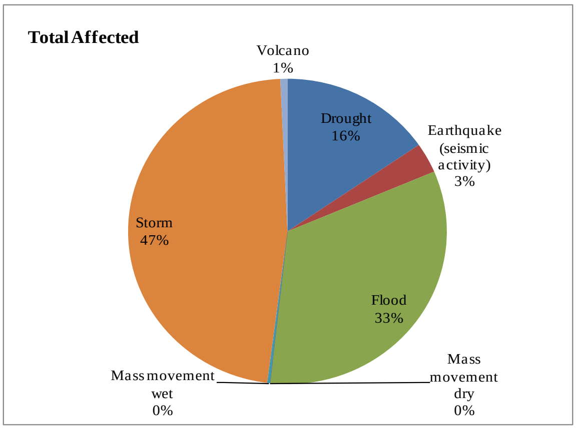
**Total Number of Deaths:**

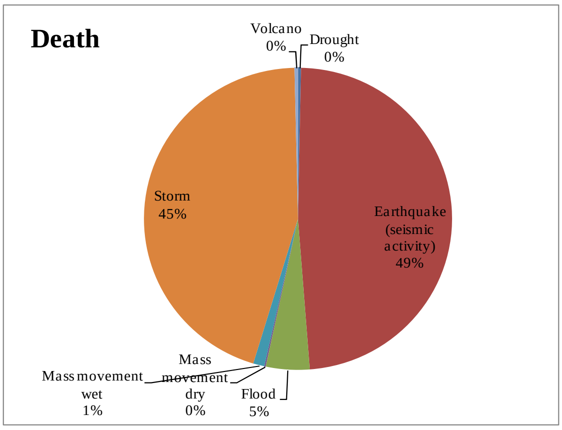
Figure 2.2.3 shows that 49% of deaths were due to 'earthquake' followed by 'storm (45%)'; these two disasters take 94% of the total death from natural disasters (Figure 2.2.3 above). In particular, 'earthquakes[3] (including tsunamis)' have the largest number of 'death per event' (Figure 2.2.3 middle), implying its devastating effects on human lives even with one occurrence.

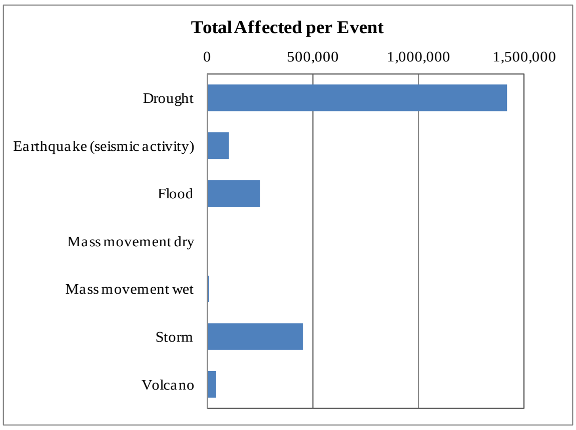
It should be noted that in case of 'mass movement (dry)', 80% of affected people had been killed (Figure 2.2.3 below) that is the remarkable characteristic of the disaster of 'mass movement (dry)'. Mass movement (dry) will have fatal impacts on human who are to be involved.

[2] EM-DAT defines: Severe Storm: A severe storm or thunderstorm is the result of convection and condensation in the lower atmosphere and the accompanying formation of a cumulonimbus cloud. A severe storm usually comes along with high winds, heavy precipitation (rain, sleet, hail), thunder and lightning"

[3] EM-DAT does not include the terminology 'tsunami' in the 'disaster type' of the data base of July version.



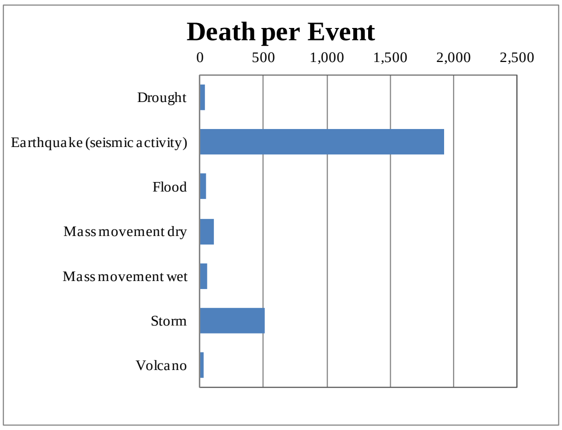



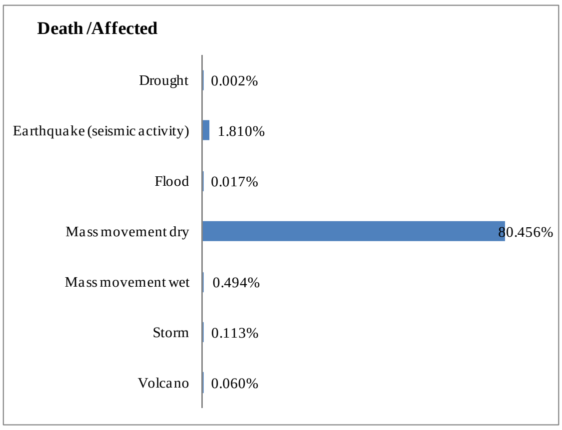




| Total Affected | Total Affected | % | Nos of Disasters | Total Affected per event |
|---|---|---|---|---|
| Drought | 51,030,144 | 15.4% | 36 | 1,417,504 |
| Earthquake (seismic activity) | 10,526,945 | 3.2% | 99 | 106,333 |
| Flood | 109,697,680 | 33.1% | 433 | 253,343 |
| Mass movement dry | 701 | 0.0% | 5 | 140 |
| Mass movement wet | 939,325 | 0.3% | 85 | 11,051 |
| Storm | 156,402,854 | 47.3% | 344 | 454,659 |
| Volcano | 2,358,679 | 0.7% | 54 | 43,679 |
| Total | 330,956,328 | 100% | 1,056 | 2,286,710 |

Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

**Figure 2.2.2 Total Number of Affected People in the ASEAN Region (1980-2011)**



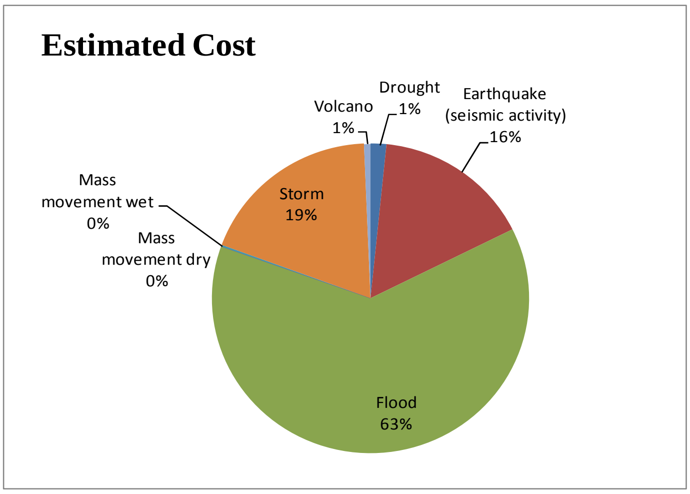

| Death | Death | % | Nos of Disasters | Death per event | Death /Affected |
|---|---|---|---|---|---|
| Drought | 1,274 | 0.3% | 36 | 35 | 0.002% |
| Earthquake (seismic activity) | 190,489 | 48.4% | 99 | 1,924 | 1.810% |
| Flood | 18,115 | 4.6% | 433 | 42 | 0.017% |
| Mass movement dry | 564 | 0.1% | 5 | 113 | 80.456% |
| Mass movement wet | 4,643 | 1.2% | 85 | 55 | 0.494% |
| Storm | 176,706 | 44.9% | 344 | 514 | 0.113% |
| Volcano | 1,409 | 0.4% | 54 | 26 | 0.060% |
| Total | 393,200 | 100% | 1,056 | 2,709 | 0.119% |

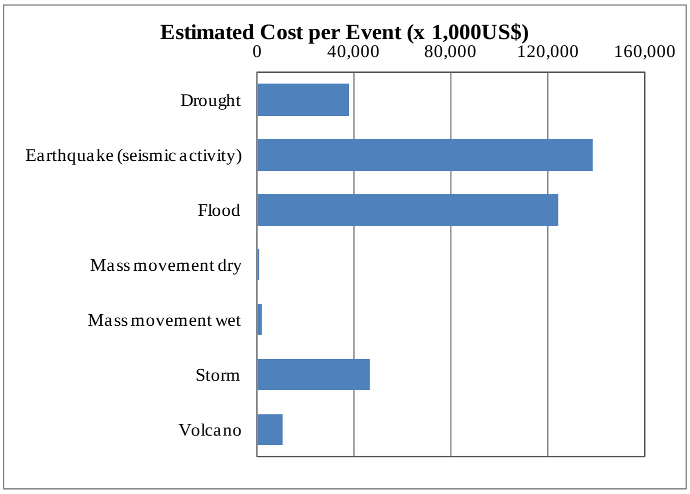
Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

**Figure 2.2.3 Total Number of Deaths in the ASEAN Region (1980-2011)**

**Estimated Cost per Disaster:**

Figure 2.2.4 shows that 63% of the estimated cost of disasters in the ASEAN region is due to flooding followed by ‘storm (19%)’ and ‘earthquake (16%)’. This implies that flood disasters have caused serious economic damages in the ASEAN region for the past 32 years (1980-2011).Among the estimated cost due to flood about 37% (45.7 million USD) is due to the flood in Thailand (2011). This event indicates that natural disasters striking industrial areas will cause great economic losses. On the other hand, earthquake disasters (including ‘tsunami’) have the largest number in estimated cost per event followed by flood, implying its destructive effects on tangibles that can be converted to cost.




| Estimated Cost | Estimated Cost | % | Nos of Disasters | Estimated Cost per event |
|---|---|---|---|---|
| Drought | 1,365,873 | 1.6% | 36 | 37,941 |
| Earthquake (seismic activity) | 13,733,201 | 16.0% | 99 | 138,719 |
| Flood | 53,771,117 | 62.8% | 433 | 124,183 |
| Mass movement dry | 1,000 | 0.0% | 5 | 200 |
| Mass movement wet | 156,326 | 0.2% | 85 | 1,839 |
| Storm | 16,024,450 | 18.7% | 344 | 46,583 |
| Volcano | 560,472 | 0.7% | 54 | 10,379 |
| Total | 85,612,439 | 1 | 1,056 | 359,844 |

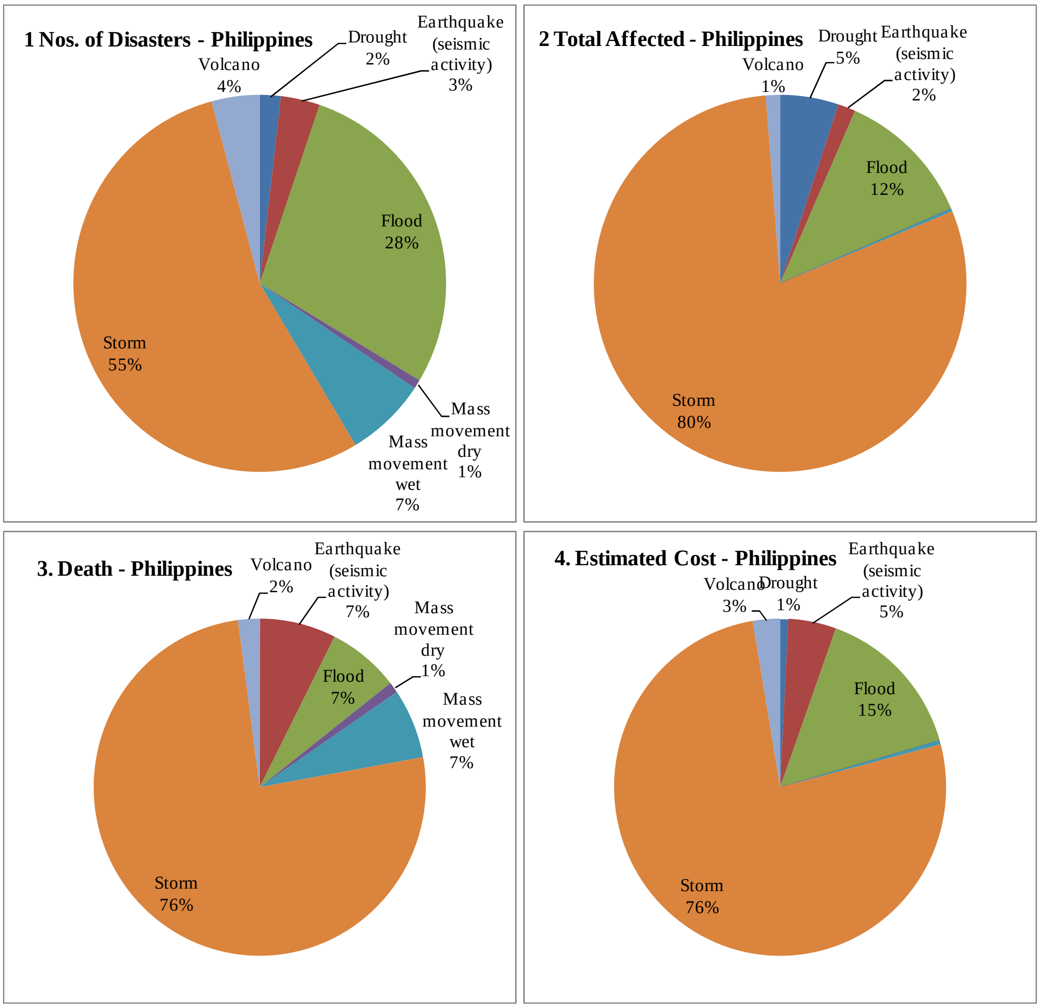
Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

(x 1,000US$)

**Figure 2.2.4 Estimated Cost per Disaster in the ASEAN Region (1980-2011) (x US$1,000)**

## 2.3 Outline of Natural Disasters

Figure 2.3.1 shows that storm is the most frequent disaster occurring (55% of the total number of disasters) in Philippines causing 80% of total affected people, 76% of total death, and 76% of estimated cost (damage) followed by flood and earthquake. Mass movement caused a similar number of deaths as to the earthquake and flood though mass movement does not show a significant estimated cost (economic loss). This may be because mass movement occurred mainly in rural mountainous areas in the Philippines.




| | Drought | Earthquake (seismic activity) | Flood | Mass movement dry | Mass movement wet | Storm | Volcano | Total |
|---|---|---|---|---|---|---|---|---|
| 1 Nos. of Disasters - Philippines | 7 | 13 | 109 | 3 | 27 | 209 | 16 | 384 |
| 2 Total Affected - Philippines | 6,549,542 | 1,979,293 | 15,414,285 | 0 | 317,516 | 103,563,950 | 1,585,713 | 129,410,299 |
| 3. Death - Philippines | 8 | 2,540 | 2,396 | 361 | 2,304 | 26,055 | 719 | 34,383 |
| 4. Estimated Cost - Philippines | 64,453 | 380,025 | 1,234,883 | 0 | 33,281 | 6,265,657 | 216,282 | 8,194,581 |

Data from 1980 to 2011
Data Source: "EM-DAT: The OFDA/CRED International Disaster Database
www.emdat.be - Université Catholique de Louvain - Brussels - Belgium"
Presentation: JICA Study Team (2012)

Cost ( x 1,000US$)

**Figure 2.3.1 Outline of Natural Disasters in Philippines**

## 2.4 Appendix to Chapter 2: Data Set Utilized for the Descriptions

The data set for the period of 1980 – 2011 were used for the description of the disaster outline in ASEAN region in this Chapter 2; and are presented in the tables for further reference.

The data were downloaded from "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012.

The followings are criteria for a disaster to be entered in the database and definitions for classification for damages. Please refer to the web-site indicated above, for further information.

**CRITERIA AND DEFINITION**

**CRITERIA**

For a disaster to be entered into the database, at least one of the following criteria must be fulfilled:

- Ten or more people reported killed.
- One hundred or more people reported affected.
- Declaration of a state of emergency.
- Call for international assistance.

**DEFINITION**

**EM-DAT data include the main following information:**

**Country:** Country (ies) in which the disaster has occurred.

**Disaster type:** Description of the disaster according to a pre-defined classification

**Date:** When the disaster occurred. The date is entered as follow: Month/Day/Year

**Killed:** Persons confirmed as dead and persons missing and presumed dead (official figures when available)

**Injured:** People suffering from physical injuries, trauma or illness, requiring medical treatment as a direct result of a disaster

**Homeless:** People needing immediate assistance for shelter

**Affected:** People requiring immediate assistance during a period of emergency; it can also include displaced or evacuated people

**Total affected:** Sum of injured, homeless, and affected

**Estimated Damage:** Several institutions have developed methodologies to quantify these losses in their specific domain. However, there is no standard procedure to determine a global figure for economic impact. Estimated damage are given (000’) US$

(http://www.emdat.be/criteria-and-definition)

**Table 2.4.1 Disaster Data Set of ASEAN Member States – Number of Disaster**

| No. | State | Drought | Earthquake (Ground Shaking) | Flood | Mass Movement (Wet) | Mass Movement (Dry) | Storm | Volcanic Eruption |
|---|---|---|---|---|---|---|---|---|
| 1 | Brunei | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Cambodia | 5 | 0 | 15 | 0 | 0 | 3 | 0 |
| 3 | Indonesia | 6 | 78 | 126 | 1 | 42 | 5 | 38 |
| 4 | Lao | 4 | 0 | 15 | 0 | 0 | 5 | 0 |
| 5 | Malaysia | 1 | 1 | 32 | 1 | 4 | 6 | 0 |
| 6 | Myanmar | 0 | 4 | 13 | 0 | 3 | 6 | 0 |
| 7 | **Philippines** | 7 | 13 | 109 | 3 | 27 | 209 | 16 |
| 8 | Singapore | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Thailand | 8 | 3 | 60 | 0 | 3 | 30 | 0 |
| 10 | Vietnam | 5 | 0 | 63 | 0 | 6 | 80 | 0 |
| | ASEAN | 36 | 99 | 433 | 5 | 85 | 344 | 54 |

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

**Table 2.4.2 Disaster Data Set of ASEAN Member States– Total Number of Affected People**

| No. | State | Drought | Earthquake (Ground Shaking) | Flood | Mass Movement (Wet) | Mass Movement (Dry) | Storm | Volcanic Eruption |
|---|---|---|---|---|---|---|---|---|
| 1 | Brunei | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Cambodia | 6,550,000 | 0 | 11,173,637 | 0 | 0 | 178,091 | 0 |
| 3 | Indonesia | 1,083,000 | 8,438,429 | 7,290,138 | 701 | 392,967 | 14,638 | 772,966 |
| 4 | Lao | 750,000 | 0 | 3,259,740 | 0 | 0 | 1,436,199 | 0 |
| 5 | Malaysia | 5,000 | 5,063 | 566,058 | 0 | 291 | 47,946 | 0 |
| 6 | Myanmar | 0 | 37,137 | 850,112 | 0 | 146,367 | 2,866,125 | 0 |
| 7 | **Philippines** | 6,549,542 | 1,979,293 | 15,414,285 | 0 | 317,516 | 103,563,950 | 1,585,713 |
| 8 | Singapore | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Thailand | 29,982,602 | 67,023 | 46,426,691 | 0 | 43,110 | 4,235,503 | 0 |
| 10 | Vietnam | 6,110,000 | 0 | 24,717,019 | 0 | 39,074 | 44,060,402 | 0 |
| | ASEAN | 51,030,144 | 10,526,945 | 109,697,680 | 701 | 939,325 | 156,402,854 | 2,358,679 |

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

**Table 2.4.3 Disaster Data Set of ASEAN Member States – Total Number of Deaths**

| No. | State | Drought | Earthquake (Ground Shaking) | Flood | Mass Movement (Wet) | Mass Movement (Dry) | Storm | Volcanic Eruption |
|---|---|---|---|---|---|---|---|---|
| 1 | Brunei | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Cambodia | 0 | 0 | 1,382 | 0 | 0 | 44 | 0 |
| 3 | Indonesia | 1,266 | 179,378 | 5,382 | 131 | 1,757 | 6 | 690 |
| 4 | Lao | 0 | 0 | 135 | 0 | 0 | 72 | 0 |
| 5 | Malaysia | 0 | 80 | 196 | 72 | 96 | 275 | 0 |
| 6 | Myanmar | 0 | 145 | 422 | 0 | 109 | 138,709 | 0 |
| 7 | **Philippines** | 8 | 2,540 | 2,396 | 361 | 2,304 | 26,055 | 719 |
| 8 | Singapore | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Thailand | 0 | 8,346 | 3,493 | 0 | 47 | 895 | 0 |
| 10 | Vietnam | 0 | 0 | 4,709 | 0 | 330 | 10,650 | 0 |
| | ASEAN | 1,274 | 190,489 | 18,115 | 564 | 4,643 | 176,706 | 1,409 |

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

**Table 2.4.4 Disaster Data Set of ASEAN Member States – Estimated Cost (x US$1,000)**

| No. | State | Drought | Earthquake (Ground Shaking) | Flood | Mass Movement (Wet) | Mass Movement (Dry) | Storm | Volcanic Eruption |
|---|---|---|---|---|---|---|---|---|
| 1 | Brunei | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Cambodia | 138,000 | 0 | 919,100 | 0 | 0 | 10 | 0 |
| 3 | Indonesia | 89,000 | 11,349,576 | 2,452,016 | 1,000 | 120,745 | 0 | 344,190 |
| 4 | Lao | 1,000 | 0 | 22,828 | 0 | 0 | 405,951 | 0 |
| 5 | Malaysia | 0 | 500,000 | 1,012,500 | 0 | 0 | 53,000 | 0 |
| 6 | Myanmar | 0 | 503,600 | 136,655 | 0 | 0 | 4,067,688 | 0 |
| 7 | **Philippines** | 64,453 | 380,025 | 1,234,883 | 0 | 33,281 | 6,265,657 | 216,282 |
| 8 | Singapore | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Thailand | 424,300 | 1,000,000 | 44,355,408 | 0 | 0 | 892,039 | 0 |
| 10 | Vietnam | 649,120 | 0 | 3,637,727 | 0 | 2,300 | 4,340,105 | 0 |
| | ASEAN | 1,365,873 | 13,733,201 | 53,771,117 | 1,000 | 156,326 | 16,024,450 | 560,472 |

Data source: "EM-DAT: The OFDA/CRED International Disaster Database; www.emdat.be - Université Catholique de Louvain - Brussels - Belgium" in July 2012

# CHAPTER 3 ORGANIZATION AND INSTITUTION

## 3.1 Disaster Management Law and Policy

The Disaster Risk Reduction and Management Act (Republic Act 101211) were issued in 2010 aiming at strengthening disaster management system with the management framework. The act also institutionalizes the management plan and appropriation fund. The act contains the paradigm shift from emergency response to disaster prevention and mitigation.

Republic Act 101211 complements with the Climate Change Act (Republic Act 9729) in terms of implementing rules and regulations.

The Philippines has formulated the roadmap known as the Strategic National Action Plan 2009-2019 to sustain disaster risk reduction initiatives stated some decades ago in Presidential Decree 1566. The action plan enforces institutionalization of disaster risk reduction to be integrated into government policy.

## 3.2 Disaster Management Plan and Budget

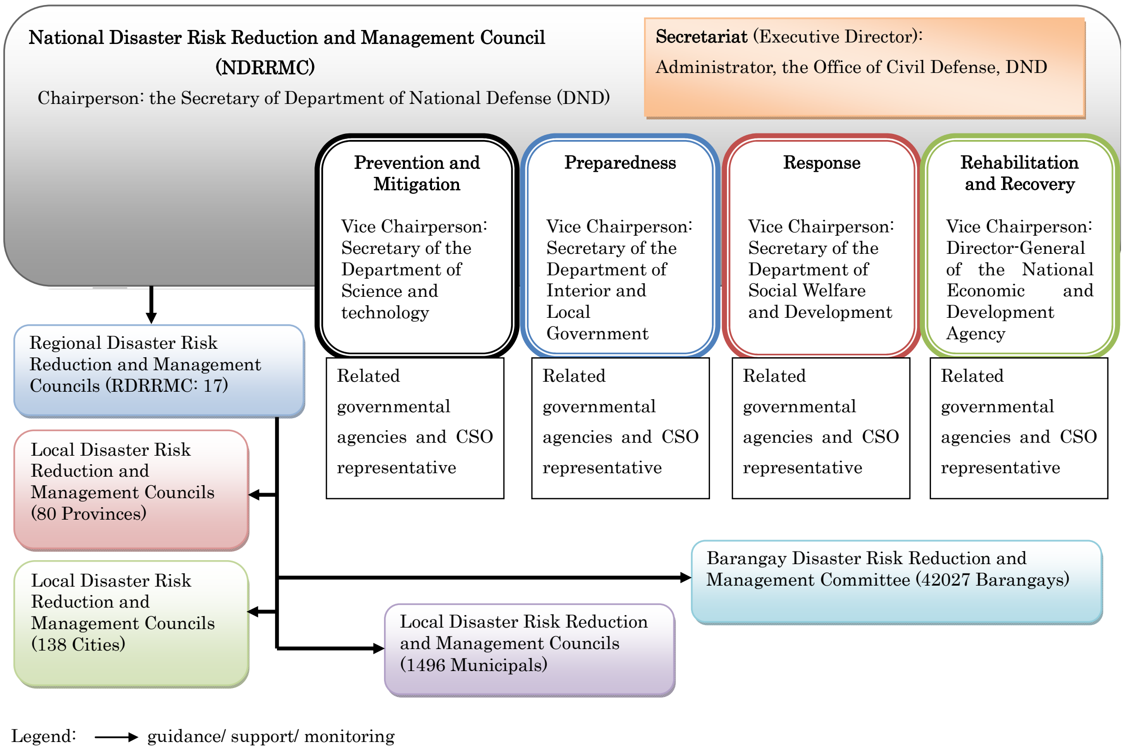
In February 2012, the National Disaster Risk Reduction and Management Plan (NDRRMP) 2011-2028 were approved. NDRRMP covers four thematic areas, namely, i) disaster prevention and mitigation, ii) disaster preparedness, iii) disaster response, and iv) disaster rehabilitation and recovery, with the indication of the expected outcome, outputs, activities, lead agencies, and partners setting timelines from short- to long-term. An implementation plan is also believed to be necessary.

Although local level disaster risk reduction management plans are to be prepared, the guideline for planning is still in preparation.

The Philippines used to have a budget framework called the Calamity Fund, which has been renamed and converted into the Disaster Risk Reduction and Management Fund, according to Republic Act 101211. Thirty percent (30%) of this new fund is allocated for the Quick Response Fund (Stand-by Fund) and is available even for disaster mitigation and prevention activities. At the local level, 5% of expected revenue from regular resources is set aside for the Local Disaster Risk Reduction and Management Fund (LDRRMF), and 30% of which is allocated as Quick Response Fund (Stand-by Fund).

## 3.3 Disaster Management Organization

The National Disaster Coordination Council was renamed as the National Disaster Risk Reduction Management Council (NDRRMC)” by Republic Act 101211. More authority is granted to NDRRMC followed by the increment of its membership from 23 to 43 (including participants from civil society and private sector). The chairperson of NDRRMC is the Secretary of the Department of National Defense (DND) and four vice co-chairpersons are also appointed in charge of four thematic areas mentioned in Section 3.2. The Administrator of the Office of Civil Defense (OCD), DND is appointed as the Executive Director for NDRRMC. Figure 3.3.1 below shows the organizational structure in more detail.




Source: JICA Study Team.

Note: Local level disaster risk reduction and management councils are supposed to be established as follows: (1) 17 RDRRMCs (Region) (2) LDRRMCs (80 provinces, 138 cities, 1496 municipalities, (3) BDRRMCs (42027 *Barangays*[1]. RDRRMCs are chaired by the OCD Regional Directors, while other respective level is chaired by the Local Chief Executives.

**Figure 3.3.1 Philippines' Disaster Management Structure**

## 3.4 Disaster Management at the Community Level

The NDRRMP indicates that for Issue 2: Disaster preparedness, the target of capacity development of community including improvement of disaster risk awareness should be set. OCD had planned the International Disaster Management Day in 2009 to promote national public awareness. Every July is set as National Disaster Awareness Month.

Metro Manila, in the National Capital Region, has implemented community support through local government units within the region. "Flood Control *Bayanihan* Zone Alliance[2]", for example, promotes community activities of construction, rescue, and communication in different stages of flood disaster.

[1] http://www.nscb.gov.ph/activestats/psgc/NSCB_PSGC_SUMMARY_Mar312012.pdf [Accessed: May 31 2012]
[2] Bayanihan = Helping each other

## 3.5 Issues and Needs Concerning Organization and Institution

(1) Issues[3]

a) To formulate the implementation plan of NDRRMP;
b) To formulate local disaster risk reduction management plan;
c) To embed the planning process at the local level using NDRRMP as the guide;
e) To merge the disaster risk reduction and climate change plans at the local level;
f) To optimize disaster management fund allocation and use; and
g) To build capacity of local government to lead community-based disaster management.

(2) Needs[4]

a) Preparation of implementation plan based on NDRRMP;
b) Preparation of formulation guideline of local disaster risk reduction management plans and formulation of plans;
c) Establishment of "Disaster Risk Reduction Management Center" in 17 regions equipped with information technology as the law requires;
d) Establishment of the offices for DRRMC; and
e) Establishment of a system of knowledge management of good practice for community-based disaster management and dissemination at local level.

[3] The views in b) and e) are identified by OCD in the interview with the JICA Study Team, while the views in a), c), f) and g) are attributed to the JICA Study Team.
[4] The views in b), c) and d) are identified by OCD in the interview with the JICA Study Team, while the views in a) and e) are attributed to the JICA Study Team.

# CHAPTER 4 PRESENT SITUATION OF DISASTER MANAGEMENT AGAINST PREVAILING NATURAL DISASTERS IN PHILIPPINES

## 4.1 Flood

(1) Present Situation of Flood Disaster

The Philippines nationwide is prone to flooding due to tropical storms and typhoons. According to the Office of Civil Defense (OCD), 1557 deaths and more than 3.5 million affected people were reported due to 12 tropical storms and typhoons which occurred in 2011. The number of people whose lifestyles were affected by flood and the monetary amount of flood damages are increasing over time.

(2) Risk Assessment

Various hazard maps for 22 provinces for earthquake, tsunami, landslide, flood, and volcano have been developed based on the existing maps prepared by the National Mapping and Resource Information Authority (NAMRIA) through the READY Project[1], which was funded by the UNDP and AusAID. The project was initiated by the National Disaster Risk Reduction and Management Council (NDRRMC) in cooperation with other organizations, and was completed in December 2011.

On the other hand, the DREAM[2] Project, which is one of 8 components of the NOAH[3] Project launched by the Department of Science and Technology (DOST), plans to conduct flood simulation for 18 river basins as well as improving meteo-hydrological network and 3D mapping by the use of a radar profiler.

(3) Monitoring / Early Warning System

The FFWS operated by PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration) under DOST have been established for the strategic 5 river basins of Pampanga, Agno, Bicol, Cagayan and Marikina. Out of those PAGASA's systems, only Marikina's system was developed with an assistance of KOICA, and is outside the control of HMD (Hydro-Meteorological Division) of PAGASA. In addition, the Marikina river basin has two or more systems and/or monitoring equipments such as a flood forecasting system called EFCOS[4] under the control of MMDA (Metro Manila Development Authority), and monitoring equipments developed by Advanced Science and Technology Institute (ASTI) under DOST. As for the other areas except for the above 5 basins, warning is issued in the form of rainfall.

[1] Hazard Mapping and Assessment for Effective Community-Based Disaster Risk Management
[2] Disaster Risk Exposure and Assessment for Mitigation
[3] Nationwide Operational Assessment of Hazards
[4] Effective Flood Control Operation System (EFCOS consists of two phases, the first and the second phases were completed in 1992 and 2001, respectively. Although initially EFCOS project was implemented as a project of Department of Public Works and Highways (DPWH), it was transferred to MMDA in 2002.)

Out of the above basins, the systems in Bicol and Cagayan have not been functioning well due to malfunctioning of gauging devices, inadequate update of H-Q curves, and inappropriate setting of warning water levels. Rehabilitation works have just been started in the Bicol River basin with Japan's non-project grant aid.

Once flood forecasting is completed by PAGASA, the result is reported to the OCD and concerned organizations. There is an attempt to disseminate warning information issued by the OCD to the public through local government networks, while real-time information is also available through PAGASA's website, mass media, and SNS.

(4) Preparedness / Prevention and Mitigation

Various structural measures including construction of dams and river improvement works have been implemented in accordance with Medium Term Philippines Development Plan.

During floods, discharge released from reservoirs is controlled based on discussions among members of Joint Operation and Management Committee, which is chaired by the director of PAGASA. Regarding dam operation, capacities for the issuance of forecasting and warning in the lower to middle reaches of Pampanga, Agno, Cagayan and Bicol river basins have been improved through the technical cooperation project "Strengthening of Flood Forecasting and Warning Administration Project", which was conducted for two years from 2004. However, capacities for forecasting and warning in the upper reaches are not enough, and there are still issues on appropriate forecasting and warning for whole river basin. In this regard, to enhance capacities for forecasting and warning for while river basin by improving capacities for in the upper reaches, "Strengthening of Flood Forecasting and Warning System for Dam Operation" is being conducted from October 2009 to December 2012 with technical and financial assistance of JICA.

Land use regulation is stipulated in some areas for the purpose of preventing encroachment in sandbars along river banks. However, recognition and regulation by local governments are not adequate. Due to this, during the tropical storm in 2011, a whole village was flushed away by floods in some areas in Cagayan de Oro and Iligan cities. Various structural measures including construction of dams and river improvement works have been implemented in accordance with the Medium-Term Philippine Development Plan.

During floods, discharge released from reservoirs is controlled based on discussions among members of the Joint Operations and Management Committee, which is chaired by the Director of PAGASA. Each dam has its own reservoir operation rule, however it has been pointed out that some reservoirs have not been operated in accordance with the rule.

Land use regulation is stipulated in some areas for the purpose of preventing encroachment in sandbars along riverbanks. However, recognition and regulation by local governments are not adequate. In this regard, during a tropical storm in 2011, entire villages were flushed away by floods in some areas in Cagayan de Oro and Iligan cities.

(5) Emergency Response

As exemplified by floods mentioned below, the promotion of community-based disaster management had exerted an effect on the reduction of flood damages.

In May 2009, the province of Zambales was devastated by flooding due to passage of a storm but no casualties were recorded. This was mainly attributed to the community based flood early warning system (CBFEWS) in place.

In December 2011, Surigao del Sur recorded 2 casualties compared to Cagayan de Oro and Iligan City (more than 1,000) due to the passage of the tropical storm Washi. In 2005, CBFEWS was established under the UNDP Ready project. People in the area still remember the lessons during the flood drills conducted. LGUs immediately convened the local DRRMC in anticipation of storm Washi.

(6) Issues and Needs

- There are a number of areas that require establishment of flood early warning systems and flood control project implementation with structural measures. The biggest challenges is how to realize National Flood and Hazard Forecasting and Mitigation Program, which was initiated by presidential decree, in the major 18 river basins that were newly targeted by DOST.[5].
- With respect to dam operations, there are needs of advisories for various studies on possibilities of reviewing the dam operation rules, reallocating flood control capacity, and introducing a legal system with regards to reservoir operation rules[5].
- As part of non-structural measures, it is necessary to strengthen land use regulations through capacity development of local government for flood management, relocation of illegal settlers residing in river lands, and review of certification system for land use[5].

## 4.2 Earthquake and Tsunami

(1) Present Situation of Earthquake and Tsunami Disaster

The Philippines is located on the seduction zone of the Philippine Sea Plate and the Eurasian Plate. The Philippines Sea Plate is subducting underneath the Philippine archipelago from east to west at the east side. On the other hand, the Eurasian Plate is subducting underneath the Philippine archipelago from west to east at the west side. There are many inland active faults in the Philippines. Especially, the Philippine Fault longitudinally traversing the middle part of the archipelago divides the territory into the east and west sides. A large number of various scale earthquakes have occurred in the Philippines. One of the most significant natural hazards to be monitored is the earthquake, because large-scale earthquakes have occurred time and again. Such large-scale earthquakes include the one which occurred in seas off the coast of Mindanao Island in 1976 (M=7.9 and 4,791 deaths), the Luzon Island Earthquake in 1990 (M=7.9 and 1,283 deaths), the Mindoro Island Earthquake and tsunami in 1994 (M=7.1 and 41 deaths), and the Negros Island Earthquake in 2012 (M=6.9 and 51 deaths).

[5] The view is attributed to the JICA Study Team.

The coastlines of the Philippines total to about 34,000 km. In this regard, significant tsunami disasters caused by earthquakes are anticipated. The tsunamis which occurred around Mindanao Island killed 41 people in 1994 and seven people in 2002.

Table 4.2.1 shows records of main earthquake occurrences in the Philippines.

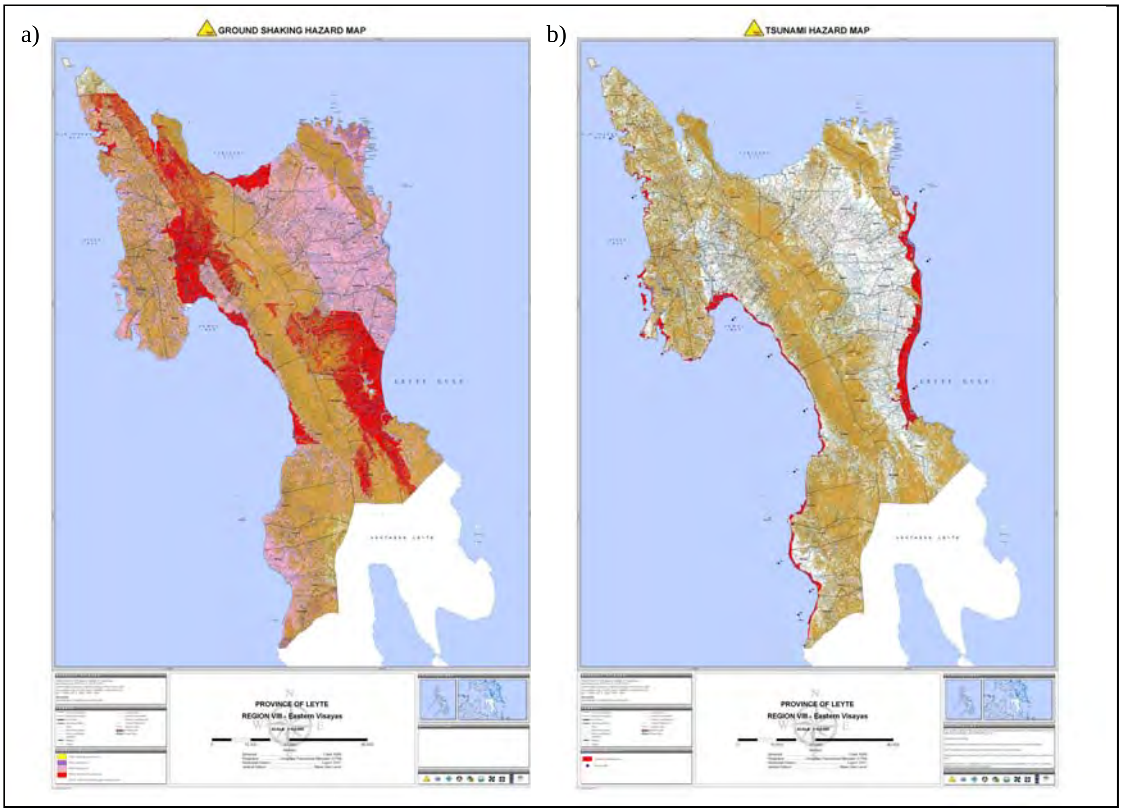
**Table 4.2.1 Main Earthquake/Tsunami Disaster History in the Philippines**

| Date | Location | Comment | Mag. | Source |
|---|---|---|---|---|
| 1976/8/16 | Moro Gulf | Tsunami occurred. 3700 people died, 8000 people were injured, affected 12,000 households. PHP 0.276 billion worth of damage. | | 2 |
| 1990/7/16 | Luzon | A massive earthquake struck Luzon area and Samar provinces. The earthquake caused 1283 death and 2786 injured. It is reported that 1,225,248 people and 227,918 households were affected by the earthquake. PHP 12.226 billion worth of damage. | | 1 |
| 1994/11/14 | Mindoro | Tsunami occurred. 41 people died, 430 people were injured, affected 22,452 households. PHP 0.515 billion worth of damage. | | 2 |
| 1999/12/12 | Luzon (Manila Region) | Northern provinces in the Philippines were jolted by a strong tremor. The earthquake produced 6 casualties and 40 injured. | | 1 |
| 2002/3/5 | Mindanao | Tsunami occurred. 7 people died. PHP 1.714 billion worth of damage | | 3 |
| 2007/5/6 | Ilocos | Orange earthquake alert in the Philippines. No casualties and little damage expected. More information on GDACS | 5.5 | 1 |
| 2009/9/19 | South Cotabato | Two earthquake incidents both of tectonic origin occurred on September 18 and 19, 2009 in South Cotabato. 76 houses damaged, 91 people injured. | | 1 |
| 2012/2/6 | Negros | 51 people died, 62 were missing, 112 were injured, 320,165 people affected, 6352 houses collapsed, 9435 houses were partly destroyed. | 6.9 | 4 |

Source: (1) Asian Disaster Reduction Centre (ADRC), GLobal IDEntifier Number (GLIDE) http://www.glidenumber.net/glide/public/search/search.jsp,
(2) PHIVOLCS (http://www.phivolcs.dost.gov.ph),
(3) National Oceanic and Atmospheric Administration (NOAA) National Geophysical Data Center (NGDC) http://www.ngdc.noaa.gov/hazard/earthqk.shtml,
(4) Philippines News Agency (http://www.pna.gov.ph/index.php)

(2) Risk Assessment

The hazard maps of 22 provinces have been developed in the READY Project with assistance from the UNDP and AusAID. CBDRMs including development of evacuation plans were supported in the READY Project based on the hazard maps. Figure 4.2.1 shows one of the hazard maps for earthquake and tsunami disaster in the western part of Visayan Islands, Philippines.




Source: PHIVOLCS (2007)

**Figure 4.2.1 a) Earthquake Ground Shaking Hazard Map, b) Tsunami Hazards Map**

The microzoning hazard maps of Metro Manila with scale of 1:5,000 were developed in the JICA development study "Earthquake Impact Reduction Study for Metropolitan Manila, Republic of the Philippines" conducted in 2004. PHIVOLCS initiated the upgrading of the microzoning hazard map by itself for completion in 2013.

PHIVOLCS conducted tsunami simulations in the "Tsunami Mitigation Program" from 2006 to 2007. Based on the simulations, tsunami hazard maps with scales of 1:100,000 to 1:50,000 in the three islands of Luzon, Mindanao, and Visayas were developed.

PHIVOLCS has also produced the software Rapid Earthquake Damage Assessment (REDAS) which anticipates seismic damages after a strong earthquake occurs. They held training seminars on REDAS in local government units (LGUs) and other relevant authorities in order to promote REDAS to other organizations.

The SATREPS project "Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information Project" has been conducted by JICA and JST form 2010 to 2015. The project aims to assist tsunami simulations for various cases and to produce a database.

The JICA Study Team recommended to develop microzoning hazard maps similar to the one made for Metro Manila for other cities such as Cebu and Davao with populations of over one million, where there is the threat of a large-scale earthquake and tsunami. And preparedness such as hazard mapping has yet to be developed in comparison with city's development. There is a need to develop regional disaster management plans based on these hazard maps[6].

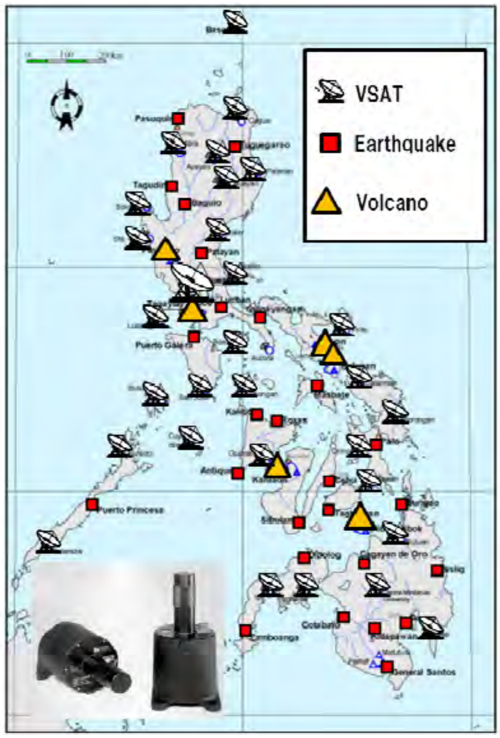
Since PHIVOLCS has upgraded the microzoning hazard maps of Metro Manila by itself, the JICA Study Team also recommended that the development of microzoning maps of local cities should be initiated by PHIVOLCS.

(3) Monitoring / Early Warning System

PHIVOLCS has a total of 66 seismological observatories (Figure 4.2.2), comprised of which 30 manned seismic observatories, 30 unmanned seismic observatories, and six observatories in Metro Manila. PHIVOLCS has planned to increase the number by at least 85 seismological observatories by 2016. The SATREPS project "Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information Project" by JICA and JST plans to provide 100 broadband seismographs and ten strong motion accelerographs. The accuracy of hypocenter and magnitude determination shall be improved by improvement of seismic observation density and upgrading of devices.

The software EQ-Plotter and REDAS developed by PHIVOLCS and PCIEERD can determine hypocenters and magnitudes, and anticipate damage automatically in case of an earthquake. PHIVOLCS disseminates earthquake information within 15 minutes after an earthquake.

Regarding tsunami observation, PHIVOLCS has one tsunami detecting instrument called "WET sensor" used for monitoring. PHIVOLCS disseminates tsunami warning through mass media (TV and radio) and to the OCD and LGUs.




Source: PHIVOLCS, *Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines (2010 – 2014)* (PPT, 3)

**Figure 4.2.2 Seismic Observation System Location Map**

PHIVOLCS has planned to increase five tsunami WET sensors. NAMRIA has been observing tide levels with high accuracy at 18 stations. It is necessary to cooperate with each other to utilize tide observation for tsunami warning.

Tsunami information has been acquired from international agencies including the Japan Meteorological Agency (JWA) and the Pacific Tsunami Warning Center (PTWC). Since the

[6] All views are attributed to the JICA Study Team.

WET sensor was designed to detect tsunami occurrence only along coastal areas, it does not detect a local tsunami occurring in the sea around the Philippines before the tsunami arrives. The JICA Study Team recommended installing new tsunami detecting buoys or submarine cables.

Earthquakes occurring in the sea around the Philippines probably trigger tsunamis that could hit and largely damage its surrounding countries such as Malaysia, Vietnam, Brunei, Singapore, Taiwan, and China, at areas facing the South China Sea. Therefore, the JICA Study Team recommended that these countries share information and strengthen cooperation in earthquake and tsunami observation among neighboring countries.

(4) Preparedness / Prevention and Mitigation

A law regarding quake resistance standards was enacted in 1992 and amended in 2004. Basic seismic intensity was decided based on local standards in the Philippines and seismic resistant design was established following AASHTO of the US. In Metro Manila, hazardous areas where liquefaction is anticipated have been limited from constructing public buildings and structures.

The Department of Public Works and Highways (DPWH) doesn’t have sufficient knowledge and experience of aseismic design for bridge, and has yet to establish appropriate standard and technology for improvement of aseismic construction. DPWH has independently conducted retrofitting works for bridges. However, the measures done were at a basic and minor level, such as collapse preventive devices of bridge girder and patching on bridge pier. The DPWH has also constructed a seawall for high tides and storm surges on the coastal area of Roxas Boulevard in Manila.

In a JICA development project regarding improvement of bridges for mitigation of large-scale earthquake impact, there is plan on conducting a study on quake resistance, draft revision of seismic resistant design standards, and technical transfer for seismic strengthening works of bridges in and around Metro Manila. Based on the project, there is a need to reinforce important public structures against earthquake, train engineers for aseismic design, and support public awareness for aseismic design and reinforcing buildings against earthquake[7].

The JICA Study Team recommended that, based on implemented risk assessment, important infrastructure such as for transportation, and port, school, hospital and government buildings should be strengthened against seismic disaster. Similarly, preparedness to tsunami disaster is needed based on risk assessment and impact analysis along the coastal areas.

(5) Emergency Response

The OCD, PHIVOLCS and relevant authorities have published a pamphlet, poster, and video, and also conducted nationwide earthquake evacuation drills targeting school. The evacuation plan and evacuation route signboards based on the tsunami hazard maps created in the READY Project have been developed.

[7] All views are attributed to the JICA Study Team.

The MMDA established contingency plans and developed emergency response plans, and also prepared essential materials and equipment for disaster rescue and relief.

(6) Issues and Needs

1) Issues[8]

a) Improve the accuracy of hypocenter and magnitude determination by increasing seismic observation density and upgrading of devices.
b) Review and upgrade the earthquake damage estimation for Metro Manila including its surrounding areas, and reinforcement of important public structures against earthquake based on the upgraded estimation.
c) Assess earthquake damage and to establish disaster management plans in large local cities such as Cebu and Davao.

2) Needs[9]

a) Enhancement of earthquake and tsunami monitoring networks.
b) Integrated urban disaster management plan for Metropolitan Manila and its surrounding area (including earthquake damage estimation, reinforcement against earthquake and public awareness.)
c) Earthquake damage estimation and integrated urban disaster management for large local cities such as Cebu and Davao.

## 4.3 Volcano

(1) Present Situation of Volcanic Disaster

There are about 220 volcanoes in the Philippines that are located on the boundary of tectonic plates. There are 23 active volcanoes in the Philippines. Mayon Volcano has erupted actively within short periods of intervals in 1968, 1978, 1993, 2000, and 2001. When Mayon Volcano erupted in 1993, about 70 people died and more than 60,000 people evacuated. Pinatubo Volcano erupted in 1991 and debris flow occurred after the eruption, in which more than 900 people died or were missing and more than 90,000 evacuated.

The eruption of Pinatubo Volcano in 1992 largely damaged not only buildings and infrastructures around the volcano but also aviation traffic due to ash fall, and has a huge impact on the local economy. Seven airports including the Manila international airport closed for around one week due to ash fall, and at least 16 commercial aircrafts encountered the ash cloud ejected by the June 15 eruption and a total of 10 engines were damaged and replaced. There is no accident of in-flight shutdown of an engine.

[8] All views were identified by PHIVOLCS in the interview with the JICA Study Team.
[9] All views are attributed to the JICA Study Team.

Table 4.3.1 shows the History of Major Volcanic Disasters in the Philippines.

**Table 4.3.1 History of Major Volcanic Disasters in the Philippines**

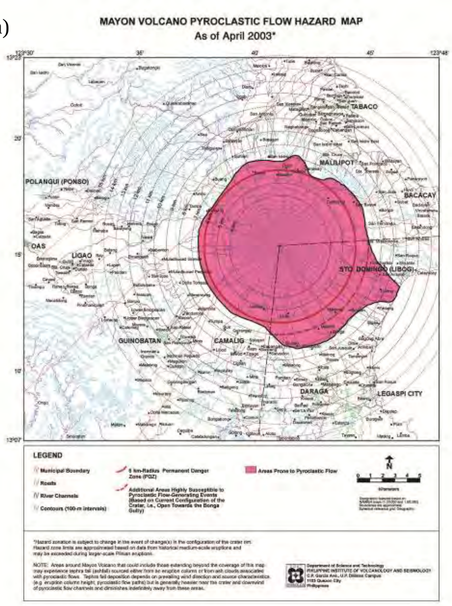
| Date | Location | Comment | Data Source |
|---|---|---|---|
| 1766/7/20 | Mt. Mayon, Luzon | Debris flow/lahar of secondary disaster. 49 people died. | 2 |
| 1814/2/1 | Mt. Mayon, Luzon | Pyroclastic flow, debris flow/lahar, thunder. 1,200 people died. | 2 |
| 1897/5/23 | Mt. Mayon, Luzon | Pyroclastic flow, volcanic ash, debris flow/lahar. 350 people died. | 2 |
| 1911/1/27 | Mt. Taar, Luzon | Pyroclastic flow and tsunami. 1,335 people died. | 2 |
| 1948/9/1 | Mt. Hibok-Hibok, Mindanao | Pyroclastic flow. 68 people died. | 2 |
| 1965/9/28 | Mt. Taar, Luzon | Pyroclastic flow, tsunami. 200 people died. | 2 |
| 1991/6/15 | Mt. Pinatubo, Luzon | Pyroclastic flow, debris flow/lahar of secondary disaster, indirect damage of epidemic and famine. More than 900 people died or were missing. | 2 |
| 1993/2/2 | Mt. Mayon, Luzon | Pyroclastic flow. 70 people died. More than 60,000 refugees. | 2 |
| 2006/8/14 | Mt. Mayon | The discharge of lava flow from Mt. Mayon started to increase in mid-July and on August 4, lava flows extended 30 m beyond the 6 km radius region designated as the Permanent Danger Zone. The Philippine Institute of Volcanology and Seismology (PHIVOLCS) issued an official advisory on August 7 raising the alert level from 3 to 4. As of August 13, PHIVOLCS reported six eruptions occurred at Mayon Volcano during the previous 24 hours.<br>Lahar following the eruption killed 1266 people. | 1<br>2 |
| 2009/12/15 | Mt. Mayon | A total of 12,415 persons evacuated as Mayon Volcano explodes. | 1 |
| 2010/11/10 | Bulusan Volcano in central Philippines | Bulusan Volcano has been ejecting ash and steam since November 6, 2010. According to the National Disaster Risk Reduction and Management Council (NDRRMC), at least 34 families, 205 persons, have already evacuated from Casiguran, Sorsogon so far. | 1 |

Source: (1) Asian Disaster Reduction Centre (ADRC), GLobal IDEntifier Number (GLIDE) http://www.glidenumber.net/glide/public/search/search.jsp,
(2) National Oceanic and Atmospheric Administration (NOAA) National Geophysical Data Center (NGDC) http://www.ngdc.noaa.gov/hazard/earthqk.shtml

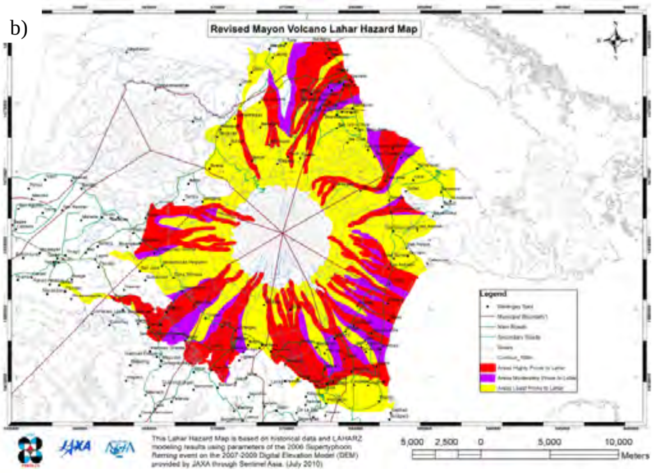
(2) Risk Assessment

PHIVOLCS developed volcano hazard maps with scale of 1/25,000 for 14 out of the 23 active volcanoes. Figure 4.3.1 shows one of the volcano hazard maps. The hazard maps have been created to identify hazardous items such as volcanic ash, lava flow, pyroclastic flow, lahar, and volcanic mud flow, and utilize such for evacuation plans, quick response and land use. Since the existing hazard maps were created from a base map enlarged from 1:50,000 scale topographic maps surveyed by NAMRIA, the accuracy of topographic information is not adequate. PHIVOLCS mentioned in the interview with the JICA Study Team that there is a need to develop new large-scale topographic maps and to improve the accuracy of topographic information. Also, it is necessary to conduct a detailed survey of other active volcanoes which are possible to erupt, and to conduct preparedness activities for volcanic disaster prevention.

a)




b)




Source: PHIVOLCS a) Mayon Volcano Pyroclastic Flow Hazard Map as of April 2003, b) Revised Mayon Volcanic Lahar Hazard Map, July 2010.

**Figure 4.3.1 Example of Volcanic Hazard Map; a) Pyroclastic Flow Hazard Map, b) Lahar Hazard Map of Mayon Volcano**

(3) Monitoring / Early Warning System

PHIVOLCS has set up observatories for six volcanoes and installed observation systems to monitor volcanic activity (see Figure 4.3.2). The observation sites and contents are shown below. PHIVOLCS installed one set of seismograph for the two volcanoes of Parker and Matutum. PHIVOLCS has started to observe there. The SATREPS project "Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information Project" by JICA and JST has been conducted. In this project, it has been planned to install instruments such as broadband seismograph, low-frequency microphone and GPS at Taal and Mayon Volcanoes, and to monitor the said volcanoes.

- Taal, Pinatubo, Mayon, Bulusan, Hibok-hibok, Kanlaon.
- Ground shaking, ground deformation, gas and water quality analysis, specific resistance and electromagnetic ray.

PHIVOLCS issues warning alerts based on volcanic observations. Volcano alert levels are classified into five levels, and are established based on eruption type and local circumstances at each volcano.

PHIVOLCS hopes to strengthen the existing observation network for accurate eruption forecast necessary for long-term forecast, exact prediction and warning and evacuation order. Also, PHIVOLCS needs to develop volcanic observation networks for the active volcanoes


Source: PHIVOLCS, *Overview of Monitoring Techniques in the Philippines*, (PPT, 2)

**Figure 4.3.2 Volcanic Observatory Location Map**

which are not under observation.

(4) Preparedness / Prevention and Mitigation

The DPWH has constructed structural measures such as sabo dams (check dams) and dykes (mega dikes, super dikes) at Pinatubo and Mayon volcanoes.

PHIVOLCS and the DPWH have conducted evacuation drills in CBDRM on a per project basis.

(5) Emergency Response

Since community-based disaster prevention plans have not yet been developed, emergency response has not been prepared systematically. The JICA Study Team recommended the development of a regional disaster prevention plan to clarify the procedures for emergency response in case of volcanic disaster, and also the promotion of emergency drills[11]. The resional disaster prevention plan should include a removal plan for accumulated volcanic ash, securement of power supply, relief plan with taking paralysis of traffic network into consideration.

(6) Issues and Needs

1) Issues[10]

- Expand the monitoring system to active volcanoes without observation instruments.

2) Needs[11]

- Expansion project of volcanic observation systems.
- Development of a regional disaster prevention plan.

## 4.4 Sediment Disaster

(1) Present Situation of Sediment Disaster

Sediment disaster induced by rainfall or earthquake have often adversely affected human lives, houses and infrastructure as weak and erosible volcanic rock and soil are distributed in the mountainous areas of the Philippines. In 2006, large-scale landslides triggered by long lasting rainfall occurred in the mountainous area of Southern Leyte Province in Leyte Island; killing 1,126 people. Sediment disasters along roads account to more than 90% of the number of sediment disasters in the Philippines. Various scales of road sediment disasters have damaged the transportation network in the country. The target facilities or areas which need to be prevented from sediment disaster are mainly the trunk roads and densely-populated places in mountainous areas.

Table 4.4.1 shows the history of major sediment disasters in the Philippines.

[10] All views are identified by PHIVOLCS in the interview with the JICA Study Team.
[11] All views are attributed to the JICA Study Team.

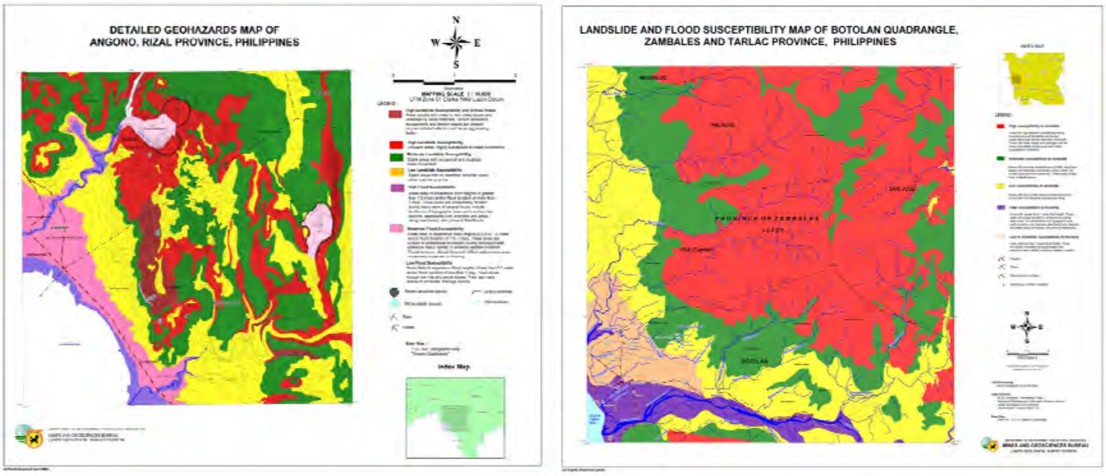
**Table 4.4.1 History of Major Sediment Disasters in Philippines**

| Date | Location | Comment |
|---|---|---|
| 2003/12/19 | Central Philippines | About 200 people may have died in central Philippines, in two landslides triggered by six days of heavy rains in the Philippines. |
| 2006/2/14 | Municipality of Sogod, Southern Leyte | Continuous monsoon rain caused death and destruction in the Philippines. A landslide in Agos in the municipality of Sogod Southern Leyte killed 11 and injured 25. Two more people were missing. Homes and crops were also destroyed or damaged. |
| 2006/9/22 | Northern Philippines | At least eight people were killed and 14 were injured when a landslide slammed into a narrow mountain road in northern Philippines, local disaster officials said on September 22. |
| 2007/1/3 | Burgy Diit de Suba, Silvino Lobos, Nothern Samar | A landslide occurred in Burgy Diit de Suba, Silvino Lobos, Nothern Samar which buried a house. Five were confirmed dead, three injured and one missing. |
| 2007/8/9 | Northern Philippines | Tropical Storm Pabuk churned across the Philippines on a Wednesday, triggering deadly landslides |
| 2008/9/8 | Masara, Municipality of Maco, Compostela Valley Province | Two landslides occurred at Poblacion Masara, Municipality of Maco, Compostela Valley Province due to heavy rains. Nine persons were reported dead, 24 injured and 14 still missing. |
| 2008/12/27 | Compostela Valley Province | Heavy rainfalls caused three landslides in Compostela Valley Province, 202 families, and 960 persons were affected. |
| 2009/5/19 | Southern Philippines | The death toll in a landslide that struck a mining village in the southern Philippines hit 26 as rescuers dug up more bodies overnight, officials said Tuesday (19/05/2009) - DPA |
| 2010/1/5 | Valencia, Cagdianao, Province of Dinagat Islands | 925 people affected by landslide due to continuous rains in Valencia, Cagdianao, Province of Dinagat Islands. |

Source: (1) Asian Disaster Reduction Centre (ADRC), GLobal IDEntifier Number (GLIDE)
http://www.glidenumber.net/glide/public/search/search.jsp,

(2) Risk Assessment

The Mines and Geosciences Bureau (MGB) has conducted geomorphic analysis and site reconnaissance, and created about 750 sheets of sediment disaster hazard maps with scales of 1:50,000 and 1:10,000 in the READY Project supported by UNDP and AusAID (see Figure 4.4.1). The hazard maps are available for browsing and download in the MGB's website (http://www.mgb.gov.ph/). The MGB issued danger advisories to barangays just after the site reconnaissance in the READY Project before providing the hazard maps to the local governments.




1:10,000 Scale Detailed Geohazard Map 1:50,000 Scale Landslide Susceptibility Map

Source: MGB, *The National Geohazards Mapping and Assessment* (PPT, 30, 32)

**Figure 4.4.1 Sediment Disaster Hazard Maps**

The hazard maps were mainly created with a scale of 1:50,000 by the MGB. These maps neither show the types or classifications of sediment hazards nor the exact occurrence locations of hazards. Hence, such maps were not utilized to develop practical disaster prevention measures such as evacuation, land use and countermeasure plans. According to the MGB, in order to create a more detailed or more specific hazard map, large-scale base maps of more than 1:10,000 scales need to be produced. Also, the JICA Study Team recommended capacity development of MGB technical staff for them to be able to identify disaster types and clarify disaster mechanisms.

In the provinces near Metro Manila such as Rizal, Bulacan, and Cavite, the residential areas of poverty-stricken people has been expanding to sloping areas. In some cases, they construct their settlements by cutting the slope, rendering such areas more susceptible to collapse. In densely populated sloping areas, accurate hazard maps as well as vulnerability maps need to be developed. The JICA Study Team recommended that regional disaster prevention plans based on risk assessment need to be developed, including structural works, monitoring, forecasting and early warning, CBDRM promotion, removal of illegal occupants, etc.

(3) Monitoring / Early Warning System

Monitoring and observation of sediment disasters have not been conducted. The JICA Study Team considered that there is a need to implement monitoring activities appropriate to the disaster type such as landslide, debris flow, slope failure, etc. Also, monitoring should be started in prioritized sites, such as those with important facilities or infrastructure, and/or having dense population around the main cities. Thereafter, early warning systems and evacuation plans need to be developed.

(4) Preparedness / Prevention and Mitigation

Based on the hazard maps created in the READY Project, the MGB has conducted public awareness activities in each community by holding workshops on sediment disaster and setting up signboards to identify the susceptible areas. In the JICA technical cooperation project "Improvement of Quality Management for Highway and Bridge Construction and Maintenance" in 2006, structural and non-structural measures for road slope stabilization were introduced to the DPWH. The response to sediment disasters except for roads is limited to the removal of fallen sediments after disaster, and evacuation and relocation of residents.

Although there are simple structural measures that were considered to reduce risks in some cases, such have not been implemented. The JICA Study Team considered that there is a need to promote structural measures, such as drainage works and gabion walls, which can be carried out by CBDRM.

(5) Emergency Response

The current major activities on emergency response are "search and rescue" after a disaster occurs. The MGB has conducted an urgent survey as an emergency response. The JICA Study Team considered that there is a need to conduct not only urgent surveys but also geotechnical analysis and monitoring in order to design permanent countermeasures for prevention of secondary disasters. Urgent observation systems, unmanned construction and emergency measures need to be introduced. It is also necessary to develop the technical capacity of the OCD, MGB and LGU.

(6) Issues and Needs

1) Issues[12]

a) To identify prioritized sediment disaster prone areas such as densely-populated areas, trunk roads and etc
b) To improve and upgrade the geo-hazard maps the prioritized areas
c) To install monitoring, early warning systems in prioritized areas
d) To develop the disaster prevention plan for local community
e) To conduct proper geotechnical analysis and monitoring even for the case of emergency as necessary

2) Needs

Study on the comprehensive sediment disaster management plan

[12] All the views are identified by MGB in the interview with the JICA Study Team.

# CHAPTER 5 DISASTER MANAGEMENT INFORMATION, EARLY WARNING AND DISASTER EDUCATION

The HFA-3 mentions that stakeholders need to use knowledge, innovation and education to build a culture of safety and resilience at all levels. In order to achieve that, it is important to collect and integrate various types of information on disaster management to be able to share, and freely use it.

In this chapter, the JICA Study Team organized an overview of the current situation and challenges of each ASEAN country regarding Disaster Management Information System (DMIS) and education for disaster prevention and mitigation.

## 5.1 Disaster Management Information System (DMIS)

**Table 5.1.1 Information System on Disaster Management (Philippines)**

| | | Availability | Competent Agency |
|---|---|---|---|
| Disaster Management Information System | | ○ | NDRRMC |
| Disaster Loss Database | | ○ | OCD, PAGASA |
| Early Warning System | Flood | ○ | PAGASA |
| | Flash Flood | - | - |
| | Typhoon/Cyclone | ○ | PAGASA |
| | Landslide | | |
| | Tsunami | ○ (Network of earthquake monitoring stations and volcano observatories) | PHIVOLCS |
| | Volcano | | |

Source: JICA Study Team, (○: available, -: not available)

(1) DMIS and Disaster Loss Database

The National Disaster Risk Reduction Management Council (NDRRMC) has established an operations center. During emergencies, the NDRRMC Operations Center is activated into an NDRRMC Emergency Operations Center (EOC) and conducts the following:

- Alert and monitoring
- Multi-agency operational coordination
- Response resource mobilization
- Information management.

The operation center has installed a DMIS that is connected with relevant agencies and local governments. In emergency situations, the center collects and integrates information on damages and responses to the disaster to take advantage of the DMIS. However, OCD pointed out a common map format among relevant agencies has not been established. For this issue, it is necessary to further research and analysis, and needs to propose more specific.

There is also the Rapid Earthquake Damage Assessment System (REDAS) as another disaster management system which was developed by the Philippine Institute of Volcanology and Seismology (PHIVOLCS) in 2002-2004. When an earthquake occurs, REDAS determines automatically the earthquake's epicenter and magnitude, and conducts damage estimation. In addition, REDAS delivers the results of estimation to relevant agencies within 15 minutes. The results can aid rescue groups in the prompt deployment of rescue and relief operations, and other life-saving activities.

The Metro Manila Development Authority (MMDA) has established a Flood Control Information Center (FCIC) which is a state-of-the-art nerve center for Metro Manila's flood control and disaster-related operations. The FCIC has 16 LCD monitors connected to over 70 closed-circuit television cameras located in key Metro Manila intersections, flood-prone areas and pumping stations. The FCIC is also connected to the telemetry system which allows the monitoring of possible pumping station operations. The FCIC also monitors the weather conditions in the West Pacific Area by its link to the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) and the National Oceanic and Atmospheric Administration (NOAA) weather monitoring websites. The center is also utilizing an incident management and map navigation software which will collate information on flood and other disaster-related incidents for use during planning and operations[1].

(2) Early Warning System (EWS)

Issuance of early warning of flood and typhoon is under the responsibility of PAGASA, while the monitoring of tsunamis and volcanic activity is under PHIVOLCS. There are currently no mechanisms of forecast and early warning of flash floods.

PAGASA conducts meteorological and hydrological observation, weather forecasting and issuance of flood warning. The river basins where PAGASA conducts flood warning total to only four basins out of 45 strategic basins. In other basins, PAGASA issues heavy rain warning instead of flood warning. The Department of Science and Technology (DOST) has a medium- and long-term plan to increase the target rivers that implements flood forecasting and warning.

PHIVOLCS has a network of earthquake monitoring stations and volcano observatories. A tsunami warning and volcano alert is issued by PHIVOLCS based on observation data. However, the volcanoes with real-time monitoring systems totals to only six out of 23 active volcanoes. The other 17 volcanoes are observed only through their seismic activities. PHIVOLCS desires to prepare instruments for carrying out emergency observation for these 17 volcanoes if their activity went up.

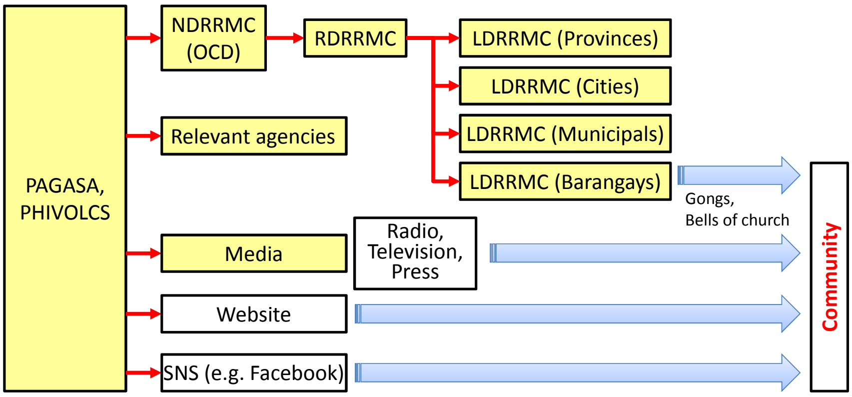
(3) Means of Dissemination of Early Warning

If a weather forecast has reached the criteria of early warning, PAGASA issues the forecast to relevant agencies immediately.

[1] MMDA, Building a Disaster Resilient Metro Manila (PowerPoint)

When OCD receives information of early warning from PAGASA, OCD disseminates the warning to residents through local governments (barangays). Barangay captains disseminate the warning to residents using gongs, bells of church. PAGASA disseminates warnings to the public through the PAGASA website, mass media, SNS (e.g. Facebook).

The mechanism of transmitting early warning to relevant agencies (include local governments like barangays) has already been established. The NDRRMC Operation Center receives weather information and flood-related information from PAGASA, as well as information of earthquake, tsunami, or volcanic activity from PHIVOLCS. The Operation Center issues early warning to relevant agencies based on these information.




Source: JICA Study Team based on the interview survey for OCD, PAGASA and PHIVOLCS

**Figure 5.1.1 Dissemination Flow of Early Warning**

According to the HFA Progress Report (2009-2011; interim), in terms of flood EWS, a community-based flood EWS and Information Dissemination Network have been implemented by PAGASA. A related program is the Enhancement of Flood Forecasting and Warning System (FFWS), which utilizes three types of flood bulletins:

- Flood Outlook - Possibility of flooding within the next 24 hours, Suggests awareness;
- Flood Alert - Threat of flooding within the next 24 hours, Suggests preparedness;
- Flood Warning - Flooding expected within the next 24 hours or flooding has occurred, Suggests response.

PAGASA implements the following programs:

- Establishment of early warning and monitoring system for disaster mitigation covering Metro Manila and Rizal Province (Pasig-Marikina River basin),
- Improvement of the flood forecasting and warning system in the Pampanga and Agno River basins which involves the construction, procurement and installation of FFWS,
- Strengthening of the flood forecasting and warning system for dam operation covering six dams in Luzon,
- Improvement of flood forecasting and warning system in Magat Dam and downstream communities,
- Strengthening of flood forecasting and warning system in the Bicol River basin.

For geophysical hazards, a community-based EWS for tsunami is being piloted by PHIVOLCS in several high-risk barangays all over the country[2].

## 5.2 Education for Disaster Prevention and Mitigation

There are primary and secondary school curricula on disaster prevention and mitigation. The Department of Education is in charge of school education. The Philippine Information Agency (PIA) is primarily responsible for public awareness and capacity building of local communities.

The Department of Education is continuing the implementation of the project on prioritizing the mainstreaming of DRR management in school and the implementation of programs and projects as mandated by Department Order No. 55 series of 2007. So far, public grade school and secondary school curricula have been updated to incorporate DRR. Lesson exemplars and other learning materials to guide both teachers and school children have been developed.

In addition, the Department of Education has also begun the integration of DRR and climate change adaptation, environment education, road safety and peace education in the basic education curriculum of public schools. The Department of Education has also prepared and distributed education, information and communication materials to schools in hazard-prone provinces on DRR and CCA.

Regarding the awareness of tsunami occurrence, people learn through pamphlets and related websites. Signboards are installed in evacuation sites. Evacuation drills are carried out in schools and communities nationwide.

PHIVOLCS has exhibits and learning materials regarding natural disaster. PHIVOLCS invites school students to their exhibits and teaches them on natural disaster.


Source: JICA Study Team

**Figure 5.2.1 Exhibitions of Learning Materials for Natural Disaster at PHIVOLCS**

2 Source: HFA Progress Report (2009-2011)-interim, Philippines

## 5.3 Issues and Needs Identified - Philippines

The JICA Study Team identified the issues and needs as shown in the Table 5.3.1.

**Table 5.3.1 Issues and Needs Identified by the Study Team (Philippines)**

| Issues and Needs | Bilateral cooperation |
|---|---|
| Development of Disaster Management Information System | - Development of disaster management information system based on GIS. |
| Enhancement of Disaster Education for CBDRM | - Assistance of CBDRM (e.g. Evacuation drills, Community based hazard mapping, Building shelter management system and evacuation plans, improvement of early warning system, Formulation of community disaster manual and awareness plan)<br>- Development of guide lines how to conduct CBDRM.<br>- Development for knowledge sharing mechanism among communities.<br>- Capacity Building for implementing CBDRM |

Source: JICA Study Team

# CHAPTER 6 PREPAREDNESS FOR EFFECTIVE RESPONSE

## 6.1 Current Situation of Preparedness for Emergency Response

It is planned to prepare a National Disaster Response Plan, which is a scenario-based disaster preparedness plan including the system of search, rescue and recovery in each rescue area.

With the support of UNHCR since 2003, the manual by the title of Contingency Planning for Emergency has been produced and distributed to local government units to develop their contingency plans. Most cities/municipalities have prepared contingency plans for flood hazard. Nevertheless, results of a disaster preparedness audit that was conducted to survey local government units found that 33% of provinces, 34% of cities and 60% of municipalities are not prepared in terms of the functionality of the Local Disaster Risk Reduction and Management Council (LDRRMC), availability of evacuation centers, appropriate equipage, and quality of the disaster risk management plan[1].

Financial reserves for emergencies are secured under the Disaster Risk Reduction and Management Fund". Both the national and local government levels have prepared quick response funds or stand-by funds for relief and recovery programs.

During response and relief operations, OCD operates and maintains the NDRRMC Operation Center (it becomes Emergency Operations Center in a disaster).

Drills are regularly conducted in schools and hospitals by the Departments of Education and Department of Health. Every year, a National Disaster Consciousness Month is set where earthquake drills and search and rescue exercises are conducted. In the case of Metro Manila, a flood disaster preparedness program, called the Metro Manila Inclement Weather Emergency Preparedness and Response Plan has been prepared. Alliances like community-based preparedness and response groups are created with participants coming from local communities and the private sector. Through the program as an example of public-private partnership, flood boats are designed and fabricated for use, not only during flood disaster, but during normal circumstances for clean-up operations.

It is observed that rescue items and stockpiles are reserved within containers under the bridges or spaces as such.

## 6.2 Issues and Needs of Assistance for Emergency Response

(1) Issues[2]

a) To include a contingency plan into the local level disaster risk reduction plans
b) To revise contingency plans as the national disaster response plan, making it responsive to multi-hazards
c) To mobilize local disaster risk reduction and management fund as Act 101211 requires

[1] The Philippines (2011) *National Progress Report on the Implementation of the Hyogo Framework for Action (2009-2011)-Interim*, p.29.
[2] The views in a) b) and c) are identified by OCD, while the view in d) is identified by the JICA Study Team.

d) To increase relief items for all local administration level (to identify local units where relief items are inadequate)

(2) Needs[3]

a) Preparation of multi-hazard type of contingency plan together with SOPs

b) Preparation of local disaster risk reduction plan containing local contingency plan, when necessary

c) Standardizing local disaster risk reduction plan by strengthening knowledge management of good practices for planning and preparedness

d) Assessment of the status of stockpiles and its distribution system

[3] The views in a) and b) are identified by OCD and Metro Manila Development Authority, while the views in c) and d) are identified by the JICA Study Team.

# CHAPTER 7 NEEDS IDENTIFICATION FOR DISASTER MANAGEMENT

This chapter summarizes the survey results and describes the proposals for ASEAN regional collaboration in disaster management.

## 7.1 Issues and Needs According to Themes

### 7.1.1 Institution / Organization

(1) Institutional Issues: Disaster Management Law

In keeping with the strategic goals of Hyogo Framework for Action (HFA), ASEAN countries have shifted their disaster management policy focus from responsive to preventive and mitigating orientation. As such policy shift is still in transition, not all ASEAN countries have established their institutional foundation in terms of legal and organizational arrangements.

Out of ten ASEAN countries, four countries (Brunei, Indonesia, the **Philippines**, and Thailand) have disaster management law. Three countries, namely Cambodia, Myanmar, and Vietnam, are in the process of enacting their disaster management law within 2012 or in 2013. Lao PDR expects to formulate and enact disaster management law by 2013. Malaysia needs more steps to start preparing its disaster management law. It seems unnecessary for Singapore to have its comprehensive disaster management law aside from other related laws, because it is relatively free from natural hazards.

Disaster management law is fundamental especially for effectively conducting disaster preventive/mitigating activities as government budget allocation for disaster management attributes to its legal basis. While many countries have spared a portion of special budget through emergency funds when disaster strikes, an integrated budget for comprehensive disaster prevention and mitigating activities is scarcely prepared as these resources are normally allocated to respective sector ministry without sufficient coordination. Such integration of the budget will, on the other hand, require a comprehensive disaster management plan and a specialized agency as its preconditions.

(2) Institutional Issues: Disaster Management Plan and Organization

1) Readiness of Disaster Management Plan of ASEAN countries

Preparation of disaster management plan varies from country to country among ASEAN countries. Four out of ten ASEAN countries (Indonesia, the **Philippines**, Thailand, and Vietnam) possess disaster management plans. Brunei's disaster management plan consists of: i) Strategic National Action Plan and ii) Standard Operating Procedure. Cambodia had a plan for some years but has not been implemented as intended because its legal basis was not yet put into place. Lao PDR is currently drafting the plan to obtain legal approval. Myanmar is in the process of revising its plan together with necessary legal re-arrangement including organizational re-structuring (to be completed within 2012). It seems enough for Singapore to have existing national contingency plan. Disaster management plans at the local level are also expected to be prepared; however, it is an issue for most of ASEAN countries in terms of how these will be well-prepared.

2) Disaster Management Organization at the National Level

All ASEAN countries have disaster management organizations. Most of them are composed of committees presided by high level government authority and secretariats, which are most likely under the leading ministry for disaster management. These committees are organized mainly for emergency response, and the secretariats are expected to deal with disaster prevention, mitigation and preparedness apart from emergency arrangements, without enough resources and authority in most cases. Although a shift of policy focus on disaster management from emergency response to prevention, mitigation, and preparedness has been observed in most of ASEAN countries, it would be necessary for existing secretariat organizations to have clearer mandates and authority or to be an independent agency just like a case of Indonesia in order to make inter-governmental coordination as well as disaster management activities smooth.

**Table 7.1.1 Institutional Conditions of Disaster Management in ASEAN Countries**

| Institutional Conditions | | | Brunei | Cambodia | Indonesia | Lao PDR | Malaysia | Myanmar | **Philippines** | Singapore | Thailand | Vietnam |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Disaster Management Law | Presence | | O | <2013> | O | <2013> | -[*2] | <2012> | O | -[*3] | O | <2013> |
| | Enacted <Planned> Year | | 2006[*1] | | 2007 | | | | 2010 | | 2007 | |
| Disaster Management Plan | Presence at the National Level | | O[*4] | O[*5] | O | -[*6] | -[*7] | O | O | O[*8] | O | O[*9] |
| | Presence at the Local Level | | O | O | O | O[*10] | O[*11] | . | O | -[*12] | O | O |
| Disaster Management Organization | National Level | Committee | O | O | O[*13] | O | O | O | O | O | O | O |
| | | Secretariat | O[*14] | O | | O | O | O | O | O | O | O |
| | Local Level | | O | O | O | O | O | O | O | -[*15] | -[*16] | O |
| Community-based Disaster Management | | | O | -[*17] | -[*17] | -[*17] | -[*17] | -[*17] | -[*17] | O | -[*17] | -[*17] |

Source: JICA Study Team

Note: ‘O’: Available; ‘-’: Not Available

1*: Disaster Management Order subrogates the law; 2*: Malaysia needs more steps to start preparing disaster management law; 3*: It seems unnecessary for Singapore to have comprehensive disaster management law aside from other related laws because it is relatively free from natural hazards; *4: It consists of SNAP and SOP; *5: Implementation issue exists; *6: It will be approved within 2012; *7: SOPs subrogate it; having the plan is considered unnecessary; *8: Emergency plan subrogates it; *9: The plan is to be revised; *10: Five out of 16 provinces prepared it; *11: It will be revised; *12: It seems not necessary; *13: Committee is within the implementing organization; *14: It is still an interim arrangement; *15: It seems not necessary; *16: Local administrations provided its function; *17: Implemented mainly through donor-led program.

3) Disaster Management Organization at the Local Level

Disaster management organizations are also set up locally in most of ASEAN countries. Many of them, however, are established in order to prepare/respond to emergency circumstances which frequently and seasonally occur. Local disaster management organizations are expected to prepare local disaster management plans on the basis of their respective national plan, which extend their functions to mitigation and prevention activities. Local disaster management organizations are also involved in the community-based disaster management activities, with the assistance of external donors in most cases. Generally, community-based disaster management seems not comprehensive as its activities are partial and often serve as ad hoc through donor supports. To make it sustainable, it needs an institutional foundation at the local level by enhancing the capacity of local government organization for disaster management.

Table 7.1.1 summarises the institutional/organizational conditions of ASEAN countries.

According to the information in Table 7.1.1 concerning institution and organization matters obtained by the study, the JICA Study Team identifies and summarizes the issues and needs for cooperation as shown in Table 7.1.2. The JICA Study Team considers that the cooperation can be provided bilaterally between Japan and respective ASEAN country, or can be regionally provided among ASEAN countries as shown in Table 7.1.3.

**Table 7.1.2 Issues and Needs on Institution/Organization**

| Issues and Needs | Country | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Brunei | Cambodia | Indonesia | Lao PDR | Malaysia | Myanmar | **Philippines** | Singapore | Thailand | Vietnam |
| 1. Improve the legal system for disaster management | - | O | - | O | O | O | - | - | - | O |
| 2. Build intelligence infrastructure for disaster prevention plan as well as mitigation measures | - | O | - | O | O | O | - | - | - | O |
| 3. Formulate or update the national disaster management plan | - | O | - | O | - | O | - | - | - | - |
| 4. Implement local disaster management plan and community based disaster management | - | O | - | O | O | O | O | - | O | O |
| 5. Strengthen the organization and functions (shifting from response to prevention and mitigation) of disaster management institutions | - | O | - | O | - | O | - | - | - | O |

Source: JICA Study Team

Note: ‘O’: Issues/needs identified; ‘-’: Issues/needs not particularly identified

**Table 7.1.3 Issues and Needs for Institutional Improvement of ASEAN Countries**

| Issues and Needs | Countries | Bilateral/ ASEAN Regional Cooperation |
|---|---|---|
| Improvement of legal system for disaster management | Cambodia<br>Lao PDR<br>Malaysia<br>Myanmar<br>Vietnam | (1) Bilateral cooperation<br>International survey for information collection to standardize disaster management law for preparation, modification, and enforcement.<br>(2) ASEAN cooperation<br>Standardization of ASEAN disaster management institutional arrangement. (Lead countries: Indonesia and Thailand) |
| Building intelligence infrastructure for disaster prevention as well as mitigation measures to be planned | Cambodia<br>Lao PDR<br>Malaysia<br>Myanmar<br>Vietnam | (1) Bilateral cooperation<br>Information collection on disaster management plans and its frameworks for replication referring Japan's plan and framework as a basic case. Mitigation measures of every disaster are also collected for reference.<br>(2) ASEAN cooperation<br>Sharing basic information on disaster management plans and mitigation measures with each other in a comparative manner, for regional knowledge base to be created. |
| National disaster management plan to be formulated or updated | Cambodia<br>Lao PDR<br>Myanmar | (1) Bilateral cooperation<br>Using the frameworks of national disaster management plan of Japan, comprehensive framework is clarified.<br>(2) ASEAN cooperation<br>Standardization and modelling of national disaster management plan extracting good practices of ASEAN countries for replication and mutual learning. |
| Local disaster management plan and implementation of community based disaster management | Cambodia<br>Lao PDR<br>Malaysia<br>Myanmar<br>**Philippines**<br>Thailand<br>Vietnam | (1) Bilateral cooperation<br>Using the frameworks of local level disaster management plan of Japan, comprehensive framework is clarified for local level planning (community based disaster management component is also included).<br>(2) ASEAN cooperation<br>Standardization and modelling of local disaster management plan as well as community based disaster management practices extracted from ASEAN countries for replication and mutual learning. |
| Organizational and functional strengthening (shifting from response to prevention and mitigation) of disaster management institutions | Cambodia<br>Lao PDR<br>Myanmar<br>Vietnam | (1) Bilateral cooperation<br>Optimization of disaster management organizations including law revision. Support capacity development of professional staffs in the area of disaster management.<br>(2) ASEAN cooperation<br>Standardization of disaster management organizational structures and functions by referring the cases of advanced ASEAN countries (e.g., Indonesia and Thailand) and support latecomers. |

Source: JICA Study Team

### 7.1.2 Risk Assessment, Early Warning and Mitigation

(1) Flood Disaster Management

1) Recent Trends of Flood Damages and Overview of Needs of Countermeasures

The Typhoon Ketsana caused extensive flood damages to the **Philippines**, Vietnam, Cambodia, Laos, and Thailand in 2009. Moreover, the compounded impact of Tropical Storm Haima and Typhoon Nock-ten caused extensive damages to Myanmar, Thailand, Laos, and Cambodia in

2011. The severe flood events have confirmed major issues regarding flood damages of recent years in the ASEAN countries.

While occurrences of flash floods of rivers in mountainous and/or semi-arid lands as well as common riveine floods have been recognized, the issues on urban-type floods and urban drainage associated with rapid development of economic zones and urbanization have become obvious. It has been recognized that an increasing speed of flood peak discharge associated with development of economic zones and urbanization tends to be more rapid compared to a variability of rainfall caused by climate change. An increase of flood runoff ratio (an increase of hazard) combined with development; urbanization and expansion of slums caused by increase in poverty have rapidly aggravated the vulnerability of urban areas to floods. As a result, quantitative assessment and identification of flood risk has been highlighted as a major issue. An increase in flood risks has enhanced needs of flood insurance. Rising of sea level caused by global warming have also increased fears of flooding in agricultural areas (Mekong Delta) and urban areas (Jakarta, Ho Chi Min).

**Table 7.1.4 Summary on the Preparation of Flood Hazard Map**

| Country / *Region* | Preparation of Flood Hazard Map | | | |
|---|---|---|---|---|
| | Status | Covered Area | Map Scale | Information Source |
| Brunei | Completed | Whole country | To be confirmed | Interview |
| Cambodia | In preparation | Whole country | Large scale usable only for policy decision | Interview |
| Indonesia | Completed (large scale map) | Whole country | Each Province Level | BMKG’s website |
| Lao PDR | Partially completed | 8 Flood Prone Areas | 1:90,000 – 1:550,000 | ADPC’s report |
| Malaysia | Partially completed | 15 Flood Prone Areas | To be confirmed | DID’s PPT |
| Myanmar | In preparation | Bago region | To be confirmed | Interview |
| **Philippines** | Partially completed | 22 Provinces | To be confirmed | Interview |
| Singapore | Completed | Whole country | 1:36,000 | PUB’s website |
| Thailand | Partially completed | Whole country | To be confirmed | Govt.’s PPT |
| Vietnam | Partially completed | 4 Provinces | To be confirmed | Interview |
| *Mekong Basin* | *Completed* | *Middle to lower reach* | *1:400,000* | *MRC’s website* |

Source: JICA Study Team
Note: The above summary does not totally represent all the information provided.

Efforts have been made by ASEAN member countries in order to prepare hazard maps as shown in Table 7.1.4. However, most of the maps are of scales that are to be used for policy decisions. Those that are yet to be prepared are maps with detailed scales that will be used at the community level for preparedness and emergency response, or for detailed damage analysis for insurance purposes. This may be due to insufficient human and financial resources, including material resources such as topographic base maps of adequate scales.

The study classified the purposes of flood risk assessment as shown in Table 7.1.5 for better understanding.

**Table 7.1.5 Purposes of Flood Risk Assessment and the Corresponding Description**

| Purpose | Description |
|---|---|
| Policy Making | Formulation of the national and regional development policies on strategic areas for disaster prevention, identification of model areas, and budgetary arrangements |
| Flood Management Planning | Preparedness for emergency actions (evacuation and rescue) and relief actions |
| Preparedness and Emergency Actions | Information for disaster mitigation and prevention planning, and river basin flood control master plan |
| Damage Analysis | Damage analysis for investment on regional industrial clusters and insurance on factories, buildings, and utilities; risk assessment on economic corridors such as roads, ports, and railways |

Source: JICA Study Team (Draft Guide to Flood Risk Assessment)

Table 7.1.6 and Table 7.1.7 list example information required for corresponding purposes at the national and local levels, as well as for the local and community levels, respectively.

**Table 7.1.6 Required Information for Policy Making and Flood Management Planning**

| Purpose | National | Local |
|---|---|---|
| Policy Making | Map scale: 1:100,000– 1,000,000; Administrative boundaries; Inundation areas, water depth; Notation of flood risk class: Return period of flooding | Map scale: 1:50,000–250,000; Administrative boundaries; Inundation areas, water dept; Notation of flood risk class; Return period of flooding |
| Flood Management Planning | Map scale: 1:5,000-25,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period; Notation of flood risk class or water depth; Land uses (agricultural, industrial, commercial, residential, forest, swamp); Dikes, dams, retarding ponds, drainages, pumping stations; Roads, railways, bridges, port, air port, power stations, water supply facilities | Map scale: 1:5,000-25,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period; Notation of flood risk class or water depth; Land uses (agricultural, industrial, commercial, public, forest, swamp; Dikes, dams, retarding ponds, urban drainages; Roads, railways, bridges, port, air port, power stations, water supply facilities |

Source: JICA Study Team (Draft Guide to Flood Risk Assessment)

**Table 7.1.7 Required Information for Preparedness and Damage Analysis**

| Purpose | Local | Community |
|---|---|---|
| Preparedness and Emergency Actions | Map scale: 1:5,000-15,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period of flood; Dikes, flood posts, laud speaker posts, shelters, schools, dams, retarding ponds, drainages; Roads, railways, bridges; Safe evacuation routes, | Map scale: 1:5,000 – 15,000 or Google map, sketch map; Village or community boundaries; Inundation areas, water depth, flow velocity, return period of flood; Safe evacuation routes; Dikes, flood posts, laud speaker posts, shelters, schools, retarding ponds, drainages, ground water wells; Roads, railways, bridges, |
| Damage Analysis | Map scale: 1:5,000-25,000 with contour lines and spot elevations; Administrative boundaries; Inundation areas, water depth, flow velocity, return period; Notation of flood risk class; Land uses (agricultural, industrial, commercial, residential, forest, swamp); Flood control level of dikes, dams, retarding ponds, drainages, pumping stations; Roads, railways, bridges, port, air port, power stations, water supply facilities; Population distribution, transport quantity of trunk main roads and ports, production turnover of industrial parks; Rainfall depth, geology and forestation for land slide risk assessment. | |

Source: JICA Study Team (Draft Guide to Flood Risk Assessment)

The common issues and needs on flood disasters for ASEAN countries are summarized in Table 7.1.8 below.

**Table 7.1.8 Issues and Needs on Flood Disasters**

| Issues and Needs on Flood Disasters | Country | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Brunei | Cambodia | Indonesia | Lao PDR | Malaysia | Myanmar | **Philippines** | Singapore | Thailand | Vietnam |
| Flood early warning system and integrated planning against wide range of floods caused by typhoons and cyclones | - | O | - | O | - | O | O | - | O | O |
| Flood early warning system and integrated planning against flash floods occurred in the mountainous areas, urban areas, and semi-arid lands | O | O | - | O | O | O | O | - | O | O |
| Flood control and drainage planning for urban areas and SEZ (securement of safety degree against floods in urban areas, SEZ, and supply chains) | - | O | P | P | P | P | - | P | O | O |
| Flood control planning in economic corridors including roads and ports (securement of safety degree against floods in supply chains) | - | O | - | P | P | P | - | - | O | - |
| Urban drainage planning associated with urban land subsidence, storm surges, and rising of sea level | - | - | O[*1] | - | - | - | - | - | - | O[*2] |
| Flood risk assessment survey for the purposes of investment risk assessment and flood insurance (including development of flood hazard maps) | - | O | O | O | O | O | - | - | O | O |
| Improvement of the legal frameworks for the enactment of reservoir operation rule (Improvement of legal systems in order to prevent artificial flood disasters caused by inappropriate reservoir operation of PFI hydropower dams) | - | O | - | O | - | O | O | - | O | O |

Source: JICA Study Team
Legend: 'O' = Considered to be necessary; 'P' = considered to be potentially necessary;
'-'= Information was not made available to consider
Note 1: Regarding urban drainage planning associated with urban land subsidence, storm surges and rising of sea level, the above table shows only areas that were raised in the interview with the JICA Study Team (*1*2).
Note 2: *1 Indonesia (DKI Jakarta); *2 Vietnam (Ho Chi Ming, Mekong Delta area)

2) Proposed Aid Projects for Flood Disasters in Each ASEAN Country

To solve the above-mentioned issues, it is proposed to implement the following aid projects in each ASEAN country:

**Table 7.1.9 List of Proposed Aid Projects on Flood Disasters in Each ASEAN Country**

| Country | List of Project |
|---|---|
| Brunei Darussalam | Although the country suffers from flash floods, it is possible to procure countermeasures by the country's own fund. |
| Cambodia | (i) Formulation of the Strategic Flood Control Plan in the Kingdom of Cambodia<br>(ii) Master Plan Study on Integrated Flood Management in the Siem Reap River Basin<br>(iii) Review of Master Plan for Urban Drainage in Phnom Penh<br>(iv) Study on Flood Risk Assessment for SEZs in the Kingdom of Cambodia<br>(v) Study on the Improvement of Legal Systems for Enactment of Reservoir Operation Rules<br>(vi) Capacity Development of MOWRAM for Flood Management |
| Indonesia | (i) Study on Flood and Earthquake Risk Assessment in Bukasi – Karawang Region<br>(ii) Study on Flood and Earthquake Risk Assessment for Economic Corridors Including Tanjung Priok Port, New Kalibau Container Terminal and Planned New Airports |
| Lao PDR | (i) Formulation of the Strategic Flood Control Plan in Lao People's Democratic Republic<br>(ii) Master Plan Study on Urban Drainage in Vientiane<br>(iii) Study on Flood Risk Assessment for SEZs in Lao People's Democratic Republic<br>(iv) Study on the Improvement of Legal Systems for Enactment of Reservoir Operation Rules |
| Malaysia | (i) Study on Flood Risk Assessment for the Economic Corridor Johor – Kuala Lumpur – Penan – Kuda |
| Myanmar | (i) Master Plan Study on Integrated Flood Management in the Sittang River and the Bago River Basins<br>(ii) Study on Flood Risk Assessment for the Thirawa SEZ<br>(iii) Master Plan Study on Urban Drainage in Yangon |
| **Philippines** | (i) Technical assistance for development of flood hazard map and flood risk assessment depending on the intended use<br>(ii) Study on the Improvement of Legal Systems for Enactment of Reservoir Operation Rules |
| Singapore | Urban drainage measures for Orchard Road (commercial accumulation zone):<br>Although it is possible to procure countermeasures by the country's own fund, the issue has not been solved. There is an option that a private sector provides technical assistance for underground drainage tunnel, underground reservoir, pumping facilities, etc., which have been implemented in Tokyo. |
| Thailand | (i) Urgent Study on the Improvement of Legal Systems for Restructuring of Flood Reinsurance |
| Vietnam | (i) Master Plan Study on Urban Drainage in Hanoi<br>(ii) Study on Flood Risk Assessment for the West Hanoi SEZ<br>(iii) Master Plan Study on Urban Drainage in Ho Chi Minh<br>(iv) Formulation of the Strategic Flood Control Plan in Can Tho |

Source: JICA Study Team

3) Proposed Projects on Flood Disaster for ASEAN Collaboration

The following projects are expected to be more effective if they are implemented through ASEAN collaboration:

- Preparation of guideline on the improvement of legal systems for enactment of reservoir operation rules
- Preparation of guideline on flood risk assessment

(2) Earthquake and Tsunami Disaster Management

The present situation of monitoring and early warning system of the ASEAN member countries are summarized in the Table 7.1.10 below. For reference, the number of monitoring points in Japan is included.

**Table 7.1.10 Present Situation of Monitoring and Early Warning System in ASEAN Region**

| Country | | Broadband Seismograph | Accelero-graph | GPS | Tsunami | | EWS for Tsunami | Warning System |
|---|---|---|---|---|---|---|---|---|
| | | | | | Buoy | Gage | | |
| Earthquake Countries | Indonesia | 160 | 216 | 20 | 23 (2 Operational) | 58 | BMKG (InaTEWS) | 24 Sirens |
| | Myanmar | 12 (5 Operational) | 11 | 0 | 0 | 2 | nil | nil |
| | Philippine | 66 | 6 | 2 | 1 (Wet Censor)[*1] | 47 | PHIVOLCS | Each Barangay |
| | Thailand | 41 | 22 | 5 | 3 (All damaged) | 9 | NDWC | 328 Warning Tower |
| Surrounding Countries | Brunei | *tbc* | *tbc* | *tbc* | *tbc* | Installed | nil | nil |
| | Cambodia | nil | nil | nil | nil | nil | nil | nil |
| | Lao PDR | 2 | 2 | 9 | - | - | - | - |
| | Malaysia | 17 | 13 | 191 | 3 | 17 | MMD (MNTEWC) | 23 Sirens |
| | Singapore | 2 | 6 | *tbc* | 0 | 12 | MSS (TEWS) | Installed |
| | Vietnam | 15 | *tbc* | *tbc* | *tbc* | 2 | IoG | 10 Sirens |
| *Japan (March 2012)* | | *142 (HSS[*2]=1,270)* | *3,559[*3] 724[*4]* | *1,494* | *Tidal gauge + tsunami gauge=247[*5]* | | *JMA, others* | *Sirens/ TV /Radio /others* |

Source: All the information of ASEAN countries was collected by the JICA Study Team (2012); Information of Japan was from HP of Headquarters for Earthquake Research Promotion;

Note: *tbc*: to be confirmed; [*1] WET censor: tsunami detecting censor installed at coast land; [*2]: HSS: High sensitivity seismograph; [*3]: surface type, there are about 2,900 other points; [*4]: underground type; [*5]: there are 15 GPS tidal gauges and 35 water pressure gauges at the bottoms of the sea;

The density of monitoring instruments may differ from country to country depending on the policy taken for disaster management. In Japan for example, a monitoring network was planned to achieve (i) real time monitoring of seismic motion when eathquakes occur, (ii) understanding of geological structures that enhance seisminc motion, (iii) forcasting of strong seismic motion when earthquakes occur, (iv) real time forcasting of tsunami when earthquakes occur and (v) evaluation of possibility of tunami-earthquake (stealth earthquake). To realize those, the plan is to propose intervals of monitoring devices, which are 15-20 km for height sensitivity monitoring seismograph, 100 km for broadband seismograph, 15-20 km for accelerograph, and 20-25 km for GPS[1]. As a result, considerably dense monitoring networks have been established as shown in Table 7.1.10.

1) Indonesia

a) Enhancement of the tsunami observation system for Indonesia Tsunami Early Warning System (InaTEWS).

- Indonesia intended to establish the monitoring network for InaTEWS consisting of 160 broadband seismographs, 500 accelerometers, 40 GPSs, 80 tide gauges and 23 buoys[2].
- As shown in Table 7.1.10, the number of monitoring facilities excluding broadband seismographs, has to be increased to achieve the plan. In particular, tsunami observation buoys or other observation facilities have to be installed to the original level. Presently, the buoy observation facilities are proven to be not sustainable[3]; therefore, options such as new submarine water pressure gauge system or other alternatives have to be considered.
- As for the tide gauges, information from some gauges are transmitted to BMKG via satellite with 15 minutes delay. It is understood that the system is being upgraded to transmit data via GTS to achieve near real time monitoring.

b) Formulation of disaster management plan and BCP for Jakarta

- The Study Team also recommends an earthquake disaster management plan for Jakarta City since large scale earthquakes have not occurred for a long period. Considering that Jakarta is now being developed as an economic center of the ASEAN region, such plan is necessary to minimize effects to the city due to damage caused by large scale earthquakes.
- As recommended in the other section of this report, a comprehensive disaster management plan that includes not only earthquake/tsunami but flood as well, is recommended for formulation.
- Based on the comprehensive disaster management plan, BCP for the city will have to be formulated.

c) Research on seismology and tsunami

- Research in seismology for east Indonesia is needed, in particular for the regions facing Cleves Sea where large earthquakes are observed to occur.
- Detailed tsunami simulations have been conducted by various agencies. It is necessary to integrate these results of tsunami simulation into InaTEWS.

[1] "Fundamental Research and Monitoring Plan for Earthquake", August 1997, Headquarters for Earthquake Research Promotion, Japan (in (In Japanese)

[2] Indonesia Tsunami Early Warning System (InaTEWS): Concept and Implementation (2008)

2) Myanmar

a) Development of earthquake and tsunami observation network and capacity development for observation and analysis

- Earthquake monitoring facilities are obviously not enough as shown in Table 7.1.10. It is recognized by the Department of Meteorology and Hydrology (DMH) that seismic and tsunami observation network and early warning system should be urgently developed.
- Also, capacity development is indispensable to engineers in charge of the operation of observation system and early warning system, and analysis of earthquake characteristics (hypocenter, magnitude, and so on).

b) Formulation of disaster management plan and BCP for the main cities

- The main cities including Yangon City are located at an earthquake prone area where Sagaing Fault lies nearby and many large earthquakes have occurred. On the other hand, Yangon City as well as a new economic special zone is being developed rapidly. It is necessary to develop an earthquake and tsunami disaster management plan and BCP for Yangon City, including the special economic zone.

3) **Philippines**

a) Enhancement of earthquake and tsunami monitoring networks

- Under the Science and Technology Research Partnership for Sustainable Development (SATREPS), efforts were made for real-time earthquake monitoring, advanced source analyses and intensity observation, and evaluation of earthquake generation potential. For this purpose, broadband seismographs and accelerographs were installed, and integrated to the existing satellite telemeter monitoring network in order to realize/improve rapid estimation of ground motion, liquifaction, landslide, and tsunami through enhanced Rapid Earthquake Damage Assessment System (REDAS).
- On the other hand, it is understood that the Philippine Institute of Volcanology and Seismology (PHIVOLCS) intends to increase the number of tsumani monitoring guages rather than increasing the number of broadband seismometer. Presently, tsunami is monitored using one ‘wet censor’ (see Table 7.1.10) that is a water level guage installed at the coast remote islands, although a total of ten wet censors were originally considered to be installed[4].
- In any case, the number of tsunami observation facilities off the coast are not sufficient and should be increased.
- Similarly, the number of GPSs and accelerometer should also be increased to monitor the activities of numerous active faults traversing in the **Philippines** archipelago.

b) Integrated Urban Disaster Management Plan for Metropolitan Manila and Surrounding Areas

- An earthquake disaster management plan for Metropolitan Manila was conducted through JICA’s technical cooperation project in 2004. Through the detailed discussions on damage estimation, emergency response, Community-Based Disaster Risk Management (CBDRM)

[4] http://tsunami.ihs.ncu.edu.tw/~scstw/2007/doc/5a_01_(Dr.Dimalanta)_Tsunami%20research%20activities_Dimalanta.pdf

and other existing conditions in Manila, and necessary mitigation measures were recommended.

- Since the JICA project was conducted, urbanization of Manila area has progressed rapidly towards outside the Metropolitan area such as Marikina, Rizal, Bulacan, Cavite, and Laguna, with a total population reaching 25 million. Systematic consideration to disaster protection infrastructures have not been given to these areas, which has increased the vulnerability of Mega-Manila to disasters.
- The JICA Study Team therefore considers that review and updating of earthquake damage estimation is required in Manila including surrounding areas of Metropolitan Manila.
- Also, it is necessary to review the tsunami disasters along the coastal area of Manila Bay based on possible earthquake warning raised by the United States Geological Survey (USGS) at the Manila Trench.

c) Earthquake Damage Estimation and Integrated Urban Disaster Management for Large Local Cities such as Cebu and Davao.

- The basic concept of this project is same as that proposed for Metropolitan Manila. Cebu City and Davao City are big cities in the central and southern **Philippines**. Both cities are located at earthquake prone areas, where topographical condition is mainly coastal lowland. Thus, in case strong earthquakes occur, extensive damages of both ground shakings and tsunamis are expected.
- In order to take necessary earthquake disaster prevention measures, it is necessary to conduct damage estimation and formulate integrated disaster management plans.
- Based on the disaster management plan, priority projects for damage reduction should be selected and implemented.

4) Thailand

The Thai Meteorological Department (TMD) has installed 41 broadband seismographs installed (see the Table 7.1.10) with intervals shorter than 150 km except at some points; nine tidal gauges covering tsunami prone coastal area; and 22 accelerometer in the northwest part where many active faults are located. This deployment was achieved based on the two phased Seismic Network Project (Phase-I: 2005-2006; Phase-II: 2006-2009) initiated after the Sumatra earthquake in 2004. There may not be urgent needs for increasing monitoring stations, except replacing the damaged tsunami buoys. Issues and needs that the Study Team identified are as follows:

a) Study on the development of earthquake monitoring system and disaster prevention plan in northern Thailand

- Earthquakes epicenters in Myanmar and Lao PDR also caused damages to Thailand. However, the seismic observation networks in Myanmar and Lao PDR have not been developed well. The Study Team considers that Thailand may be in a position to assist its surrounding countries in establishing a seismic monitoring network in the bordering areas through installation of monitoring equipment and/or providing technical assistances.

- Based on the results of seismic observations, an earthquake disaster prevention plan on earthquake-resistant design and earthquake-induced landslides in northern Thailand is necessary.

5) Other Countries

a) Brunei, Malaysia, and Vietnam

Tsunamis possibly induced by earthquakes along the Manila Trench in the South China Sea will reach the coastal areas of Brunei, Malaysia, and Vietnam. These countries raised this subject and recognized the need for the establishment of monitoring and early warning system. Consequently, the Study Team recommended the formulation of tsunami disaster management plans while conducting risk/impact assessment. In particular, Brunei and Vietnam should enhance their tsunami monitoring and early warning system (Malaysia has developed their own systems).

b) Lao PDR

Development of seismic observation network and capacity development for the operation of observation network

- Earthquakes have occurred in the areas bordering Thailand and Myanmar. Monitoring facilities are definitely insufficient as shown in Table 7.1.10. Moreover, there is a need for capacity building of seismic engineers in terms of operation and maintenance of instruments and analysis of data as well.
- With the growing economy in main cities such as Vientiane, analysis technique for strong motion observation data need to be improved; and quake-resistance standards need to be developed.

c) Cambodia and Singapore

Both Cambodia and Singapore are almost free from earthquake and tsunami disasters. No urgent issues and needs were identified.

**Table 7.1.11 List of Main Projects on Seismic and Tsunami Disaster Management**

| Country | Project |
|---|---|
| Countries for detailed survey | |
| Indonesia | 1) Enhancement of the tsunami observation system for InaTEWS<br>2) Formulation of disaster management plan and BCP for Jakarta<br>3) Research on seismology and tsunami |
| Myanmar | 1) Development of earthquake and tsunami observation network and capacity development for observation and analysis<br>2) Formulation of disaster management plan and BCP for main cities |
| **Philippines** | 1) Enhancement of earthquake and tsunami monitoring networks<br>2) Integrated urban disaster management plan for Metropolitan Manila and its surrounding areas<br>3) Earthquake damage estimation and integrated urban disaster management for large local cities such as Cebu and Davao |
| Thailand | 1) Study on the development of earthquake monitoring system and disaster prevention plan |
| Other countries | |
| Brunei, Malaysia, Vietnam | 1) Formulation of tsunami disaster management plan including disaster risk assessment, proposing tsunami monitoring, and early warning systems<br>2) Regional collaborative research on the mechanism and characteristics of earthquake and tsunami induced by Manila trench |
| Lao PDR | 3) Development of earthquake observation network and capacity development for operation of observation network. |
| Singapore, Cambodia | No particular issues and needs were identified. |

Source: JICA Study Team

(3) Other Natural Disaster Management

Volcano Disasters Management

The Centre for Volcanology and Geological Hazard Mitigation (CVGHM) in Indonesia and PHIVOLCS in the **Philippines** are leading agencies that have developed volcanic hazard maps, monitoring and early warning systems targeting active volcanoes. In case of eruptions, said agencies issue evacuation orders based on their monitoring information.

When Merapi of Indonesia erupted in 2006 and 2010, 110,000 and 151,745 people were affected while less than 10 and 386 were killed, respectively. It is said that the early warnings based on monitoring were timely issued.

When Mt. Mayon of the **Philippines** erupted in 2006, and 2009-2010, though 43,849 and 141,161 people, respectively, were evacuated, no causalities were reported. This is because of the effective monitoring and early warning, and evacuation education conducted. However, following the eruption in 2006, strong rainfall produced lahar from the volcanic ash, causing boulders from said eruption to kill 1,266 people. Thus, PHIVOLCS has to enhance their monitoring and early warning plan for similar secondary disasters in its program.

SATREPS was implemented in these two countries to improve their monitoring and early warning systems of volcanic activities. Moreover, continuous improvement/enhancement of their existing volcanic observation networks is required.

Needs for volcanic disaster in ASEAN countries are summarized in Table 7.1.12.

**Table 7.1.12 List of Draft Main Cooperation Project for Volcanic Disaster**

| Country | Project |
|---|---|
| Indonesia | - Improvement/enhancement of the existing volcanic observation network |
| **Philippines** | - Expansion of volcanic observation systems<br>- Development of a regional disaster prevention plan |

Source: JICA Study Team

Sediment Disasters Management

Sediment disasters have occurred in mountainous areas including not only in residential areas, but also along trunk roads being utilized as economic supply chains. The disasters have affected human lives and social-infrastructures. Sediment disaster prevention measures to ensure a safe and secure transportation in supply chains are urgent issues in ASEAN countries

**Table 7.1.13 Issues and Needs on Sediment Disasters**

| Issues and Needs | Country | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Brunei | Cambodia | Indonesia | Lao PDR | Malaysia | Myanmar | **Philippines** | Singapore | Thailand | Vietnam |
| 1. Development/improvement of sediment disaster hazard maps for countermeasure plan, land-use plan, and evacuation plan | - | - | * | O | * | O | * | - | * | * |
| 2. Development of monitoring and early warning system including analysis technology | - | - | O | O | * | O | * | - | * | O |
| 3. Introduction and upgrading of proactive structural measure for sediment disaster | - | - | O | O | * | O | O | - | O | O |
| 4. Sediment disaster prevention planning in economic corridors to develop a safe/secure transportation | - | - | O | O | - | O | * | - | O | O |
| 5. CBDRM for sediment disaster | - | - | * | O | * | O | * | - | * | O |

Source: JICA Study Team
Note: ‘O’: Issues/Needs identified; ‘*’: Available at present, to be enhanced/improved; ‘-’: Issues/Needs not particularly relevant

The challenges and needs on sediment disaster management in ASEAN countries are summarized in Table 7.1.13.

**Table 7.1.14 List of Draft Cooperation Project for Sediment Disaster Management**

| Country | Project |
|---|---|
| Indonesia | - Study on comprehensive sediment disaster management plan in strategic priority areas |
| Loa PDR | - Development of the road disaster prevention plan for the economic corridor and capacity development for road maintenance and management sector. |
| Malaysia | - Study on sediment disaster management plan in Kundasang (Kota Kinabalu) of Sabah district, Uluk Klang of Selangor district, and Cameron Highlands of Pahang district |
| Myanmar | - Study on sediment disaster management in mountainous areas including CBDRM |
| **Philippines** | - Study on the comprehensive sediment disaster management plan |
| Thailand | - Study on the development of sediment disaster monitoring and effective utilization of SABO technology |
| Vietnam | - Study on basic sediment disaster management plan |

Source: JICA Study Team

a) Indonesia: Study on comprehensive sediment disaster management plan in strategic priority areas

Indonesia is one of the most sediment disaster prone countries in ASEAN region. The hazard maps were developed in some landslide and debris flow prone areas, and CBDRM for sediment disaster has been implemented in collaboration with JICA in some area. The disaster management composed of risk assessment, planning and implementing countermeasure, early warning and etc has not been implemented systematically. Thus, the JICA Study Team recommends the above mentioned study.

b) Lao PDR: Development of road disaster prevention plan on the economic corridor and capacity development for road maintenance and management sector.

The following are the three needs to strengthen the capacity of road management and to prevent road disasters; 1) Strengthening management capacity for sediment disaster risk reduction, 2) Improvement of countermeasures against large scale landslides, and 3) Development of early warning system for road disaster.

c) Malaysia: Study on comprehensive sediment disaster management plan in Kundasang (Kota Kinabalu) of Sabah district, Uluk Klang of Selangor district, and Cameron Highlands of Pahang district

Minerals and Geoscience Department Malaysia (JMG) raised the issues of sediment disasters in the above three areas. Though much direct information has not been made available, the Team considers the implementing the above mentioned study will provide advanced technology of Japan on sediment disaster management to Malaysia.

d) Myanmar: Study on comprehensive sediment disaster management in mountainous areas including CBDRM

There is a need to conduct countermeasures including early warning against sediment disasters in the mountainous area. The Asian Highway AH-1 that passes through Myanmar from Thailand to Bangladesh and India traverses a mountainous area where sediment disaster occurs. There is a need to improve the maintenance and management capacity of the road administrator.

e) **Philippines**: Study on the comprehensive sediment disaster management plan

The Mines and Geosciences Bureau (MGB) has developed a sediment disaster hazard map and conducted workshop and evacuation drill in areas susceptible to disasters. Consequently, it enlightened the community on disaster prevention. However, accuracy of the sediment disaster hazard map is so low due to small-scale base topographic map, which is not applicable for establishing a disaster prevention plan and evacuation plan. Monitoring system including early warning system has yet to be developed. Moreover, proactive countermeasures have not been constructed in disaster areas and thus, the main response is rehabilitation after disaster occurrence. There is a need to formulate a comprehensive sediment disaster prevention plan, where priority orders of areas susceptible to sediment disasters are decided based on the existing risk assessment. Based on the plan, improvement of the hazard map and implementation of structural and non-structural measures need to be conducted economically and effectively.

f) Thailand: Study on the development of sediment disaster monitoring and effective utilization of SABO technology

The CBDRM has been actively conducted in many communities in the mountainous areas. There are two needs to strengthen the sediment disaster management, namely, 1) Improvement of the existing monitoring system by introducing automatic observation instruments such as rainfall and river level gauge, and developing the criteria based on correlation between rainfall intensity and disaster occurrence; 2) Introduction of advanced technology on debris flow detection censor and countermeasures against the debris flow and landslides.

g) Vietnam: Study on basic sediment disaster management plan

Not much information was made available in Vietnam regarding sediment disaster management. SATREPS conducted research on disaster management in the central Vietnam. The Team considers that such assistance should be extended to other sediment disaster prone areas in Vietnam. The Study proposed will identify sediment disaster prone areas and prioritize such areas for implementation of disaster management projects.

### 7.1.3 Disaster Management, Early Warning and Disaster Education

The HFA-3 states that stakeholders need to use knowledge, innovation, and education to build a culture of safety and resilience at all levels. This section describes an overview of the current situation and challenges of each ASEAN country about disaster management information system and education for disaster prevention and mitigation.

(1) Knowledge Management - Disaster Management Information System (DMIS)

The DMIS is a system that supports disaster management planning and decision making effectively and timely for preparedness, emergency response, and recovery activities. Disaster management agencies should accumulate historical disaster data for conducting risk assessment in a normal situation. During emergency situations, such agencies shall issue early warning, order evacuation, conduct search and rescue, and other activities needed based on the monitoring results. At the same time, information on damage, disaster response, necessary support, and others will have to be collected and integrated through a disaster management information system. The information will also be shared among relevant agencies.

The present situation of DMIS, disaster loss database and early warning system are shown in Table 7.1.15 below.

**Table 7.1.15 Present Situation of DMIS and Early Warning System**

| Information System on Disaster Management | | Country | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Brunei | Cambodia | Indonesia | Lao PDR | Malaysia | Myanmar | **Philippines** | Singapore | Thailand | Vietnam |
| DMIS | | *n/a* | *u/c* | O | *u/c* | O | *n/a* | O | O | *n/a* | *n/a* |
| Disaster Loss Database | | *n/a*[*1] | *u/c* | O | *u/c* | *n/a* | *n/a* | O | *n/r*[*4] | *n/a* | O[*6] |
| Early Warning System | Flood | O | O | O | O | O | O | O | O | O | O |
| | Flash Flood | *n/a* | *n/a* | *n/a* | O | *d-n/a* | *d-n/a* | *n/a* | *n/r* | *n/a* | -p |
| | Typhoon/Cyclone | O | *n/a* | O | O | O | O | O | *n/r* | O | O |
| | Landslide | *n/a* | *n/a* | O | *n/a* | *n/a* | *n/a* | *d-n/a* | *n/r* | O | -p |
| | Tsunami | *n/a* | *n/a* | O | *n/r* | O | O | O | O | O | O[*5] |
| | Volcano (ash monitoring included) | *n/r* | *n/r* | O | *n/r* | O | *n/r* | O | O | *n/r* | *n/r* |
| | Severe weather[*2] | O | O | O | O | O | O | O | O | O | O |
| | Rough Sea | O[*3] | *d-n/a* | O | *n/r* | *d-n/a* | *d-n/a* | *d-n/a* | *d-n/a* | *d-n/a* | *d-n/a* |
| | Drought | *d-n/a* | *d-n/a* | *d-n/a* | *d-n/a* | O | *d-n/a* | *d-n/a* | *d-n/a* | O | *d-n/a* |
| | Haze | *d-n/a* | *d-n/a* | *d-n/a* | *d-n/a* | O | *d-n/a* | *d-n/a* | O | *d-n/a* | *d-n/a* |
| | Storm Surge | *d-n/a* | *d-n/a* | *d-n/a* | *n/r* | *d-n/a* | O | *d-n/a* | *d-n/a* | *d-n/a* | *d-n/a* |

Source: JICA Study Team (2012), National Progress Report on the Implementation of the Hyogo Framework for Action (2007-2009, 2009-2011)

Note: *1: Disaster losses are systematically reported, monitored and analyzed; *2: Heavy rain, Strong wind; *3: strong wind, tropical storm; *4: A disaster loss database for natural disaster is not needed because a large disaster has not occurred so far; *5: Tsunami EWS has been established only in Da Nang; *6: The database has information on main disasters since 1989, but CCFSC maintains records for much longer but only on hard-copies;

Legend: 'O': available; '*n/a*': not available; "*u/c*": under construction; "*n/r*": not relevant; *d-n/a*: data not available; -p: pilot project only

According to the above information, the following are considered as issues and needs for cooperation.

**Table 7.1.16 Issues and Needs for DMIS**[5]

| Issues and Needs | Country | Bilateral/ ASEAN Regional Cooperation |
|---|---|---|
| Development of Disaster Management Information System | Brunei<br>Myanmar<br>**Philippines***a<br>(Thailand)*b<br>Vietnam | 1. Bilateral cooperation<br>- Development of disaster management information system based on GIS.<br>2. ASEAN cooperation<br>- (proposed in the other section called "ADMIS") |
| Development of DMIS | Brunei<br>(Malaysia)*b<br>Myanmar<br>Vietnam | 1. Bilateral cooperation<br>- Establishment of a mechanism for collecting and accumulating disaster loss data.<br>- Development of disaster loss database and sharing system.<br>2. ASEAN cooperation<br>- Improvement of ASEAN DRR Portal and accumulating disaster loss data of each county. (Lead organization: ASEAN Secretariat and/or AHA Centre)<br>- Development of disaster loss database and sharing system for ASEAN Region. (Lead organization: AHA Centre) |

Source: JICA Study Team

Note: *a: Available DMIS is not GIS basis; *b: The countries are considered to be capable to establish it by herself.

(2) Education for Disaster Prevention and Mitigation

Disaster education is necessary to raise people's awareness on disaster management in general. Knowledge on disasters such as scientific information, simulating earthquake intensities by shaking tables, and evacuation drills should be practiced in schools, communities, and private sectors. It is important to know how to respond to disaster in order to save own lives during its occurrence. Moreover, it is also important to promote cooperation during emergency cases as a family or community unit, in order to achieve possible evacuation support, maintain evacuation sites, manage social safety, and so on.

School education serves as basic public disaster education. In order to promote school education on disaster management, education system needs to be developed systematically such as enhancement of school curriculum, textbooks, and other necessary materials.

Several ASEAN countries already prepared these education materials including pamphlets, posters, and videos. NGOs are supporting the preparation of education materials and community education.

For effective disaster education, the following items will be developed:

a) Teaching guidelines and teacher's training,
b) Education materials according to grade level,
c) Disaster simulator for earthquake, and smoke/fire extinguisher training, and
d) Regular disaster drill in schools.

In addition to school disaster education, community education is also necessary based on CBDRM. Interchange of disaster knowledge and sharing information among communities are

[5] All the views are attributed to JICA Study Team.

key items for community disaster education. Local governments should promote community disaster education in cooperation with NGOs.

Private sectors also need to conduct disaster management education and training for employees to protect or minimize damage. Based on the regional disaster management plan or governmental regulations, private sectors need to prepare emergency management plan by themselves. Regular drill for emergency management should also be conducted regularly.

According to the above information concerning Disaster Management Information System (DMIS), obtained through survey, the following are considered to be issues and needs for cooperation.

**Table 7.1.17 Issues and Needs for Education on Disaster Prediction and Mitigation[6]**

| Issues and Needs | Country | Bilateral/ ASEAN Regional Cooperation |
|---|---|---|
| (1) Enhancement of School Education | Cambodia<br>Myanmar<br>Vietnam | (1) Bilateral cooperation<br>- Development of teaching guidelines and teacher’s training.<br>- Development of teaching materials according to grade level.<br>- Development of disaster simulator for earthquake, and smoke/fire extinguisher training.<br>- Regular disaster drill at school.<br>- Development of education material databases.<br>(2) ASEAN cooperation<br>- Improvement of ASEAN DRR Portal and accumulating disaster loss data of each county. (Lead organization: ASEAN Secretariat and/or AHA Centre) |
| (2) Enhancement of Disaster Education for CBDRM | Brunei<br>Cambodia<br>Indonesia<br>Lao PDR<br>**Philippines**<br>Vietnam | (1) Bilateral cooperation<br>- Assistance of CBDRM (e.g., evacuation drills, community based hazard mapping, building shelter management system and evacuation plans, improvement of early warning system, formulation of community disaster manual and awareness plan)<br>- Development of guidelines on how to conduct CBDRM.<br>- Development for knowledge sharing mechanism among communities.<br>- Capacity building for implementing CBDRM |
| (3) Enhancement of Disaster Education for Private Sectors | All ASEAN countries | (1) ASEAN cooperation<br>- Creation of BCP guide line for private sector.<br>- Creation of BCP guide line for regional industrial clusters |

Source: JICA Study Team

6 All the views are attributed to the JICA Study Team.

### 7.1.4 Preparedness for Effective Response

(1) Needs for Early Warning System

Early warnings are issued by agencies who conduct monitoring or by disaster management agencies (or coordinating agencies). In any case, routes/means that transmit disaster information within most of administrative agencies at various levels have been established. However, the information routes from administrative agencies to public/communities have not necessarily been established. Table 7.1.18 shows the present situation of the availability of early warning mechanism.

**Table 7.1.18 Present Situation of Early Warning**

| | Information flow | | Country | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | From | To | Brunei | Cambodia | Indonesia | Lao PDR | Malaysia | Myanmar | **Philippines** | Singapore | Thailand | Vietnam |
| Means of warning dissemination (Availability of procedural guidelines, facilities/equipment, mechanism) | Monitoring Agency | Decision making agencies at National level and local level | O a | u/c a | O a | O a | O a | tel a | O a | O a | O a | O a |
| | Decision making agency | Local government | | | | | | | | | | |
| | Local government | Communities under impending hazard | * a,b | * a | O b | * a | O a | * a,b | O b | O a | O a | * a |

Notes: O: Available for operation; *: Partially available/limited function; u/c: Under construction; tel: Public telephone line only

Source: a: Interview by the Study Team, b: National Progress Report on the Implementation of the Hyogo Framework for Action (2007-2009, 2009-2011)

The main route/means of disseminating warning information to public are the mass media (television, radio, newspapers), internet (social networking websites), and the like. In some ASEAN countries, natural hazard prone communities do not receive timely and/or understandable warnings on impending hazard events. There is, thus, a common challenge/need that public should be informed of an impending hazard or be given proper information in order for them to determine whether they should evacuate or not.

Early warning systems by administrative offices issued to public other than mass media need to be installed/improved in order to realize an end to end warning dissemination to risk prone communities[7]. The early warning systems should include procedural guidelines[8], facilities/ equipment, staffing, and so on.

[7] There are means of dissemination by local staffs riding motorbikes or bicycles with loudspeakers, bells, drums, and speakers of religious facilities, etc.
[8] Including criteria for the decisions to issue evacuation orders

**Table 7.1.19 Needs for Early Warning**

| Country | Needs |
|---|---|
| Brunei[9], Cambodia[10], Lao PDR[11], Myanmar[12] Vietnam[13] | - Development means of early warning (procedural guidelines and/or facilities/equipment, mechanism) , from government agencies to communities;<br>- Implementation of CBDRM |

Source: JICA Study Team

Recently, possibly due to the prevailing climate change, flash floods occur more frequently in various areas in the world. This is also an impending issue for disaster management. Efforts have been made in various countries to predict such flash floods, though needs to be established firmly. Concurrently, with the efforts for prediction, effective and timely early warning systems should be established for flash floods.

It has also been identified that there will be significant scales of earthquakes that could happen at ocean trenches of western and southwestern islands of the **Philippines**. Such earthquakes are considered to trigger considerable scale of tsunamis that may reach surrounding countries like the **Philippines**, Malaysia (Saba, Sarawak), Brunei, Indonesia, and Vietnam facing South China Sea, Sulu Sea, and Celebs Sea.

- A concentrated research on earthquake and tsunami, hazard mapping, and so on needs to be conducted.
- At the same time, tsunami early warning systems should be installed in those coastal areas together with formulation of (tsunami) disaster management plan including public awareness programs, evacuation exercises and so on.

9 According to interview survey to Tutong District Office by the JICA Study Team (2012)
10 Interview survey to NCDM (Cambodia) by the JICA Study Team
11 Proposed by the JICA Study Team based on the interview with MDMO (Lao PDR)
12 Proposed by the JICA Study Team based on the interview with MDPA (Myanmar)
13 Proposed by the JICA Study Team based on the interview with DDMFSC (Vietnam)

(2) Disaster Preparedness

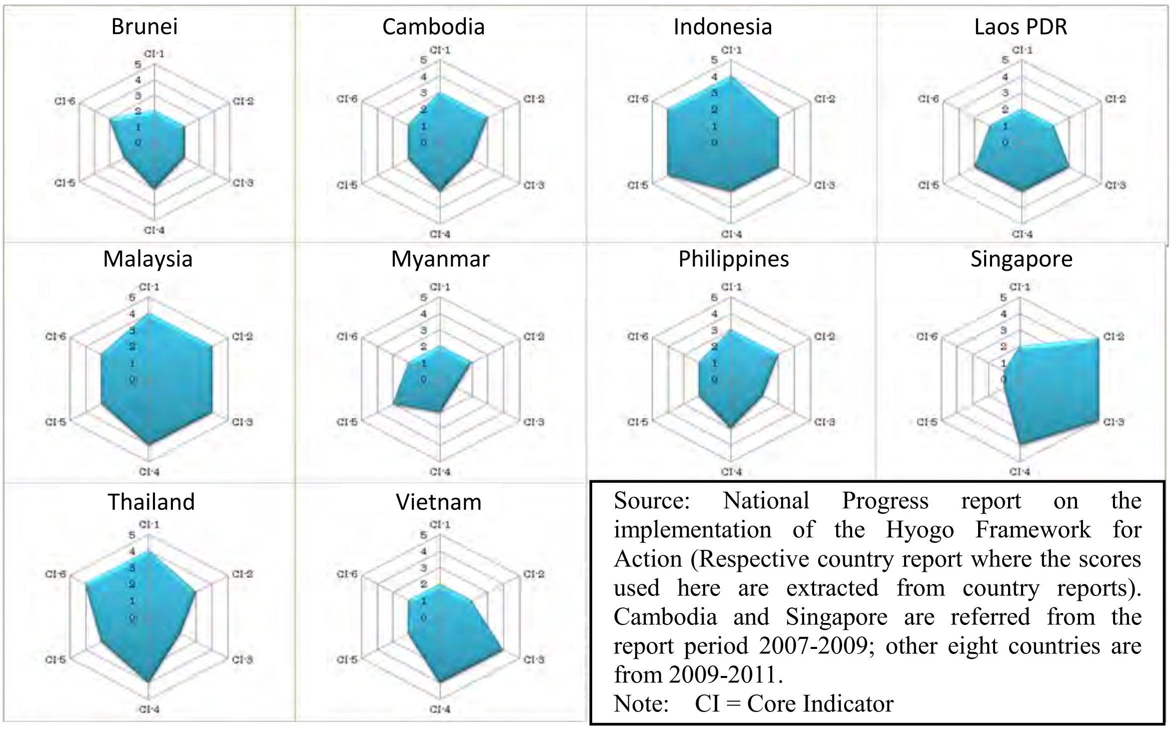
There are six core indicators proposed and used for HFA concerning "reduce the underlying risk factors".

**Table 7.1.20 Core Indicators of HFA 4: "Reduce the Underlying Risk Factors"**

| | |
|---|---|
| Core Indicator 1 | Disaster risk reduction is an integral objective of the environment-related policies and plans, including for land use, natural resource management and climate change adaptation. |
| Core Indicator 2 | Social development policies and plans are being implemented to reduce the vulnerability of populations most at risk. |
| Core Indicator 3 | Economic and productive sectoral policies and plans have been implemented to reduce the vulnerability of economic activities. |
| Core Indicator 4 | Planning and management of human settlements incorporate disaster risk reduction elements, including enforcement of building codes. |
| Core Indicator 5 | Disaster risk reduction measures are integrated into post-disaster recovery and rehabilitation processes. |
| Core Indicator 6 | Procedures are in place to assess disaster risk impacts of all major development projects, especially infrastructure. |

Source: UNISDR, Indicators of Progress: Guidance on Measuring the Reduction of Disaster Risks and the Implementation of the Hyogo Framework for Action, 2008.

Figure 7.1.1 below enumerates the evaluated results of HFA 4 core indicators of 10 ASEAN countries.




Source: National Progress report on the implementation of the Hyogo Framework for Action (Respective country report where the scores used here are extracted from country reports). Cambodia and Singapore are referred from the report period 2007-2009; other eight countries are from 2009-2011.
Note: CI = Core Indicator

**Figure 7.1.1 Results of Grading HFA 4 Core Indicators by 10 ASEAN Countries**

Glancing over above Figure 7.1.1 provides an idea on what indicators are better or worse for certain countries. Indonesia, Malaysia, and Thailand are largely high standing. Some indicators, however, are not so relevant for some countries which resulted in fewer score as progress in such indicators are not necessarily required or urgent (e.g., core indicators 1, 2, 3 and 5 for Brunei, and core indicators 5 and 6 for Singapore). Table 7.1.21 shows indicator by issues in relevant countries (principally countries graded 2 or below were chosen), which gives ideas on necessary assistance.

**Table 7.1.21 Issues by HFA 4 Core Indicators: 10 ASEAN Countries**

| | |
|---|---|
| Core Indicator 1 | (1) Lao PDR: Pervasiveness of "Environmental Impact Assessment"<br>(2) Myanmar: Development of "Environmental Impact Assessment" Framework<br>(3) Vietnam: Incorporation of Disaster Risk Assessment into "Environmental Impact Assessment" Guideline |
| Core Indicator 2 | (1) Lao PDR: Mobilization of resources to conduct "Social Safety Net" activities<br>(2) Myanmar: Widening the targeted areas to implement social development programs<br>(3) Vietnam: Mobilization of recovery fund and widening of disaster insurance options |
| Core Indicator 3 | (1) Cambodia: Prevalence of disaster risk reduction within the economic sector<br>(2) Myanmar: Formulation of policy in economic and productive sectors<br>(3) **Philippines**: Creation of reinsurance facilities as a risk transfer mechanism<br>(4) Thailand: Adaptation of disaster risk reduction in productive sector (except for agriculture sector) |
| Core Indicator 4 | (1) Myanmar: Conduct of comprehensive multi-hazard assessment, incorporating human settlements and urban planning process |
| Core Indicator 5 | (1) Cambodia: Integration of disaster risk reduction and post disaster recovery and rehabilitation into a strategy<br>(2) **Philippines**: Making recovery planning process to be proactive<br>(3) Vietnam: Resource mobilization for recovery and reconstruction |
| Core Indicator 6 | (1) Cambodia: Adding practical experience in the procedure of disaster risk impact assessment<br>(2) Lao PDR: Development of technical capacity and expertise in Environment and Social Impact Assessment<br>(3) Myanmar: Creation of assessment framework for disaster impact, especially at the community level. |

Source: National Progress Report on the Implementation of the Hyogo Framework for Action (Respective country report where above the information is extracted from). Also see the note under Table 4.1.6.<2>.

(3) Preparedness for Emergency Response

Table 7.1.22 below enumerates ten ASEAN countries with their respective conditions on preparedness for emergency response from the view point of planning, funding, operation/procedure Standard Operating Procedure (SOP), and disaster drill.

**Table 7.1.22 Preparedness for Emergency Response: 10 ASEAN Countries**

| Country | Contingency Plan | Funding | Operation/Procedure | Disaster drill |
|---|---|---|---|---|
| Brunei | - | O | O (Waiting for new SOP to be approved within 2012) | O (Conducted in 24 districts) |
| Cambodia | Expected to be approved within 2012) | O | Expected to have a mechanism of implementation | Donor led |
| Indonesia | O (20-30 Districts/ cities have prepared) | O | O (Procedures are limited to national level) | O |
| Lao PDR | Expected to be revised, while it is still limited to flood | O (not enough) | Expected to revise SOP and contingency plan | Donor led |
| Malaysia | - | O | O (i.e., Seven SOPs) | O |
| Myanmar | O (Standing order) | O (not enough) | O (i.e., Standing order) | O |
| **Philippines** | Expected to prepare plan covering multiple hazards | O | Expected to prepare SOP | O (Coverage unknown) |
| Singapore | O | O | O | O |
| Thailand | Expected to formulate new one, reflecting the lessons from 2011 flood. | O | O | O |
| Vietnam | O (It is formulated every year up to the commune level) | O (not enough) | - | Model activity to be rolled out. |

Source: JICA Study Team ; Note: O: Available

Overview of the contingency plans across 10 ASEAN countries indicates the following needs.

a) Plans need to be extended to cope with multiple disasters[14]: Lao PDR, the **Philippines**, and Vietnam; and

b) Capacity development to gain expertise[15]: Cambodia, Lao PDR, Myanmar, and the **Philippines**.

As for the operation/procedure for emergency response, certain needs are observed as follows:

a) Establishment of operation mechanism[16]: Cambodia, Lao PDR, and the **Philippines**; and

b) Preparation of SOP[17]: Lao PDR, the **Philippines**, and Vietnam.

## 7.2 Aid Projects Identified

### 7.2.1 Integrated Disaster Management Plan for Megacities in the ASEAN Region

In the ASEAN region, there are megacities having more than 10 million populations such as Bangkok, Ho Chi Min, Jakarta, and Manila. Other big cities are Davao, Hanoi, Kuala Lumpur, Surabaya, and Yangon. These cities are located mainly in the coastal lowland areas except for Kuala Lumpur. Such coastal lowland areas are relatively subject to high risks such as flood, earthquake, tsunami, and storm surge. Effects of climate change will also cause adverse impact on sea level rise, coastal erosion, rainfall intensity, and storm occurrence. Possible hazards to the ten capital cities and other major cities are listed in the table below.

[14] The need is identified by the JICA Study Team, while the Philippines identified its own need.
[15] The need is identified by the JICA Study Team.
[16] The need is identified by the JICA Study Team.
[17] The need is identified by Lao PDR and the Philippines, while the JICA Study Team identified the needs of Vietnam.

Among the megacities, Jakarta, Yangon, Manila and Bangkok should be highlighted from multi-hazard point of view.

In **Jakarta**, accumulation of social and economic infrastructure is so huge at present. Java Island is located in an earthquake prone area; however, detailed earthquake damage estimation and disaster management plan have not been prepared yet. In order to avoid or minimize earthquake disaster damage, earthquake disaster management plan shall at least be prepared at the soonest. Flooding is also a long lasting issue of this city. Rapid urbanization including excessive groundwater extraction ground subsidence has led to frequent and severe flooding, resulting in frequent disruption of capital functions. A comprehensive and integrated disaster management plan will therefore be needed. This is also necessary for risk management of business continuity with international investors.

**Yangon** is one of the hottest cities in the world in terms of economic investment. It is expected that its present population of 6 million will increase to 12 million by year 2030. Rapid urbanization will be unavoidable. It is understood that development master plan studies are in the pipe lines for urban development plan, water supply and drainage plan and plan for transportation sector. These master plan studies will incorporate factors of possible natural hazards. However, because Yangon is exposed to various types of hazard such as earthquake/tsunami originated by the Sagaing active fault, urban type floods prevailing even now, and storm surge such as Cyclone Nargis, comprehensive and integrated disaster management plan is considered to be indispensable, based on scientific hazard identification, risk and impact assessments.

In **Manila**, urbanization of its metropolitan area has extended to the north and south. Population of Mega Manila will soon reach 25 million including Bulacan, Marikina, Laguna, Rizal, and Cavite. Under this circumstance, the existing earthquake disaster management plan needs to be reviewed and updated based on recent statistics. Also, surrounding urbanized areas of Metropolitan Manila need to be included in this review. It is noted that Manila suffered from strong typhoon causing big flood disasters in 2009 and 2011, including the one caused by Typhoon Ondoy in 2009, which is compounded with storm surge. Flood disaster management is also important and necessary, especially in Metropolitan Manila. Although it is understood that a study on urban flood management in Metropolitan Manila is being conducted, a comprehensive and integrated disaster risk reduction management plan will be needed, taking into consideration the above-mentioned complexity caused by multi-hazard risks.

In **Bangkok**, after experiencing huge flood disaster in 2011, various disaster management plans for flood risk management are being prepared. However, it is also understood that the ground subsidence being caused by groundwater extraction has worsened the situation. Further, storm surge in coastal area has become a main challenging issue in addition to the risk from tsunami. Under this circumstance, comprehensive and integrated disaster risk reduction management will be needed as well for Bangkok.

**Table 7.2.1 Hazard Prone Capital Cities and Large Cities**
**- Needs for Multi-Hazard Integrated Disaster Risk Management Plan-**

| Country | Mega-city/ Big City | Potentiality of Sever Hazards | | | | | Needs of Multi-hazard I-DRMP* | Needs Raised by the Institutions |
|---|---|---|---|---|---|---|---|---|
| | | Earth -quake | Tsunami | Flood | Storm Surge | Volcano | | |
| Brunei | Bandar Sri Begawan | - | O | O | - | - | - | NDMC |
| Cambodia | Phonon Penh | - | - | OO | - | - | - | Study Team |
| Indonesia | **Jakarta** | **OO** | **OO** | **OO** | - | **O** | ☑☑ | BPBD/DKI-JKT |
| | Surabaya | O | O | OO | - | O | ☑ | Study Team |
| Lao PDR | Vientiane | - | - | OO | - | - | - | MPWT |
| Malaysia | Kuala Lumpur | - | - | OO | - | - | - | DID |
| Myanmar | **Yangon** | **OO** | **O** | **OO** | **OO** | - | ☑☑ | YCDC |
| | Naypyidaw | **OO** | - | - | - | - | - | MES/MGS |
| **Philippines** | **Manila** | **OO** | **OO** | **OO** | **OO** | **O** | ☑☑ | MMDA |
| | Davao | OO | OO | OO | OO | O | ☑ | Study Team |
| Singapore | Singapore | - | - | - | - | - | - | - |
| Thailand | **Bangkok** | - | - | **OO** | **O** | - | ☑☑ | Study Team |
| Viet Nam | Ho Chi Min | - | O | OO | O | - | ☑ | DDMFSC |
| | Hanoi | O | - | OO | - | - | ☑ | DDMFSC |

OO: High potential , O: Potential, -: Low potential (Source: JICA Study Team)
☑☑: Urgently required, ☑:Required, -: Not required
*) I-DRMP: Integrated Disaster Risk Management Plan

### 7.2.2 ASEAN Disaster Management – Satellite Imagery Analysis Technology Centre[18]

(1) Background

Satellite imagery is being utilized for quick assessment of situations soon after regional disasters occur. A mechanism of Sentinel Asia was established in 2006 to assist in disaster management of Asian countries. Under the mechanism, the countries who own satellites provide satellite information to other countries without satellites, on demand when disasters occur. It is reported that in the case of the flood of 2011 in Thailand, it analyzed satellite information provided through Sentinel Asia and successfully estimated/counted affected houses in the flooded area. It was also reported that satellite information was utilized effectively in the case of the Great East Japan Earthquake in March 2011.

The AHA Centre has recently joined the 'Sentinel Asia' as part of the Joint Project Team and is able to receive satellite information/imagery of the ASEAN member states. On the other hand, in order to utilize satellite information, analysis and/or visualization techniques of raw data are necessary together with facilities for the utilization of satellite information. Seven ASEAN countries[19] are registered as Data Analysis Nodes (DAN), who are in charge of data analysis when requested.

In order to facilitate quickest coordination when disasters occur, the AHA Centre shall have disaster information as soon as possible. For this reason, the centre shall be desired to possess

[18] This issue was proposed by the JICA Study Team (2012).
[19] Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam as of July2011.
(http://www.jaxa.jp/press/2011/07/20110727_sac_sentinel.pdf)

its own capabilities for analyzing satellite information. Further, the future step will be for AHA Centre to have its own receiving antenna, consequently allowing it to receive raw data directly from earth observation satellites (EOS) whenever necessary.

(2) Effective Use of Satellite Imagery

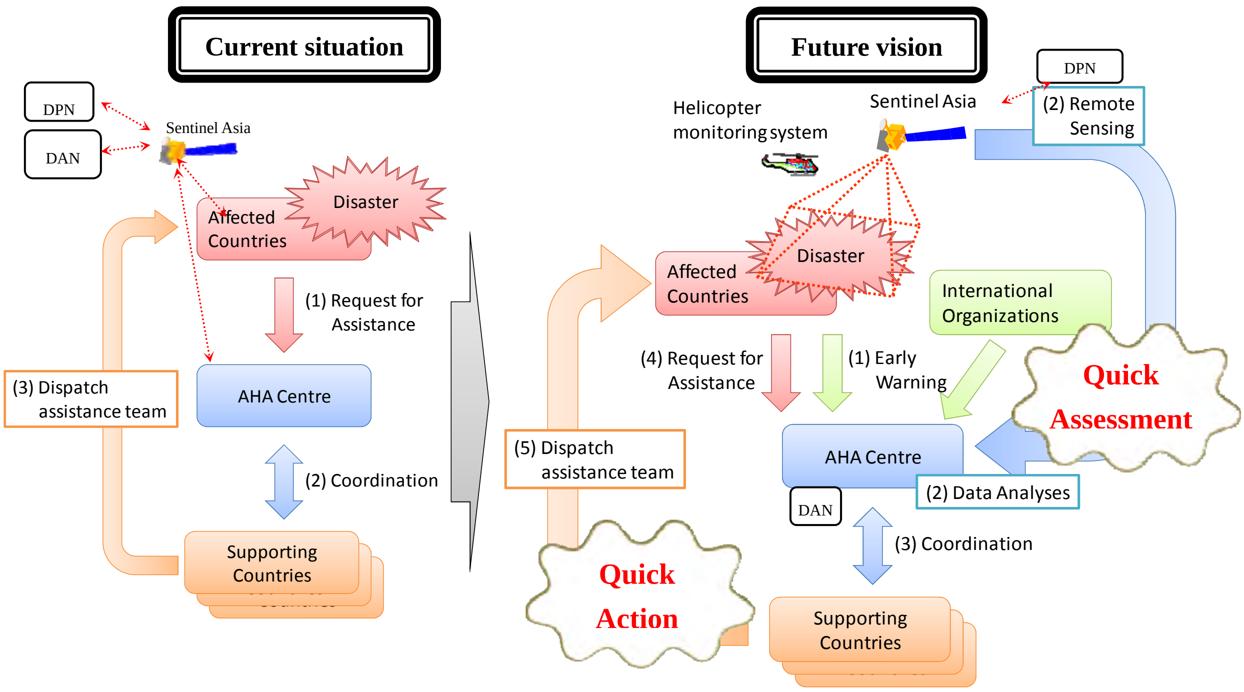
1) Present operation mechanism – Sentinel Asia

The following mechanisms have been established through Sentinel Asia:

a) Disaster struck member countries to request the Sentinel Asia for satellite images of disaster struck areas;
b) Sentinel Asia to request satellite data providers (called as Data Provider Nodes) for satellite images (raw digital information) concerned;
c) The "Data Analysis Nodes" of member organizations to analyze the raw digital information for conversion into analysed visible images (value added images); and
d) Sentinel Asia to send the value-added images to disaster struck members who requested such information.

2) Recommendation for speedy data utilization

Above-mentioned steps are required for any disaster-affected member country or AHA Centre to finally obtain analysed visible images. If AHA Centre should conduct all the steps above, a quicker impact assessment would become possible, enabling speedy response and relief activities on disasters in member countries. An image of operation mode of current situation and future vision is shown below.



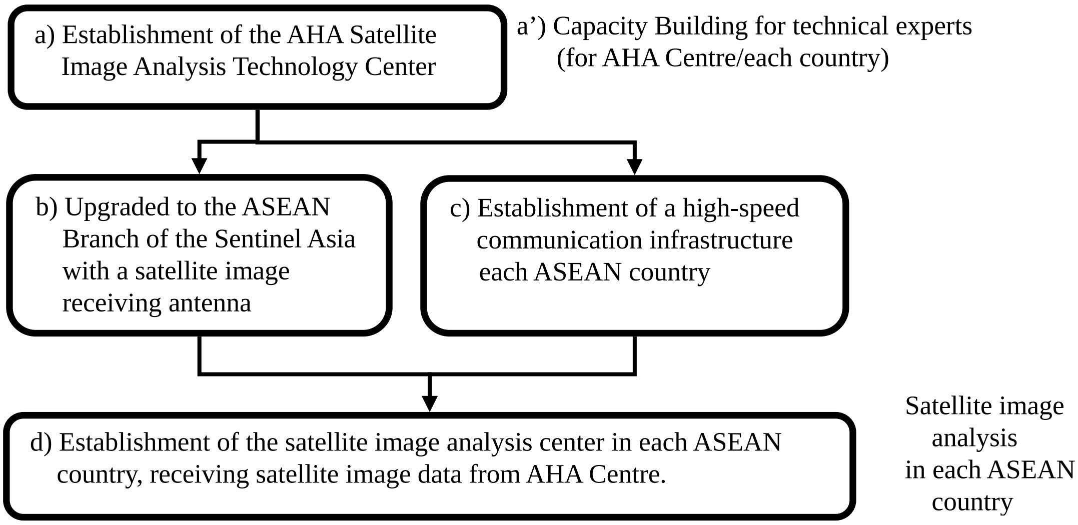

Source: JICA Study Team

**Figure 7.2.1 Comparison between Current Situation and Future Vision on ASEAN Regional Support**

Further, if each ASEAN country would have the capacity to analyse raw digital information taken by satellites, the operation speed of hazard assessment could be maximized.

(3) Recommended steps to be taken

Recommended steps for realization of the above mentioned concept is shown in Table 7.2.2 and are also illustrated in Figure 7.2.2 below.




Notes: Item codes (a) – (d) corresponds to the codes in the table below
Source: JICA Study Team (2012)

**Figure 7.2.2 Recommended Flow of Steps to be Taken**

**Table 7.2.2 Establishment of the AHA Satellite Image Analysis Technology Centre**

| Establishment of the AHA Satellite Image Analysis Technology Centre | | | | |
|---|---|---|---|---|
| Items | | | AHA Centre | Each ASEAN Country |
| 1st Step | ~3 years | a) Establishment of the "AHA Satellite Image Analysis Technology Center" for image analysis. Capacity Building for technical experts of AHA Centre. | O | |
| | | a') Capacity building for technical experts in each ASEAN country at AHA Centre | | O |
| 2nd Step | ~5 years | b) Establishment of the "ASEAN Branch Office" of the Sentinel Asia with a newly constructed image receiving antenna for direct receiving of image; for image analysis, training of AHA Centre. | O | |
| | | a') Capacity building for technical experts in each ASEAN country at the ASEAN Branch of the Sentinel Asia | | O |
| | | c) Development of communication infrastructures between AHA Centre and ASEAN countries for transmitting images | | O |
| 3rd Step | ~10 years | a') Capacity building for technical experts in each ASEAN country at the ASEAN Branch of the Sentinel Asia (tentative name). | | O |
| | | d) Establishment of the satellite image analysis center on the Sentinel Asia in each ASEAN country | | O (if required) |

Notes: item codes (a) – (d) corresponds to the codes in the figure above
Source: JICA Study Team (2012)

(4) Input needed

The following inputs will be required for the establishment of the AHA Satellite Image Analysis Technology Center:

**Table 7.2.3 Inputs Required for the Establishment of the AHA Satellite Image Analysis Technology Center**

| Step | Goal | Input required |
|---|---|---|
| First Step | To introduce satellite image analysis technology to the AHA Centre | a. Provide equipment for data analysis and relevant computer software<br>b. Dispatch experts on satellite image analysis to AHA Centre (a number of short period assignment)<br>c. Invite experts from ASEAN member countries for training on satellite image analysis (a number of short period training)<br>d. Employ experts to AHA Centre who are in charge of satellite image analysis |
| Second Step | For the AHA Centre to upgrade to "ASEAN Branch of Sentinel Asia" with own satellite data receiving antenna | a. Expand/enforce the function of the the satellite image analysis center<br>b. Construct a data receiving antenna and provide necessary equipment<br>c. Continue training to AHA Centre and the ASEAN member countries |
| | For ten ASEAN member states to be connected with high-speed communication infrastructure | a. Provide high-speed communication infrastructure connecting the ten ASEAN countries, and necessary capacity building and training |
| Third Step (in future) | To establish the satellite image analysis center in each ASEAN state, receiving satellite image data from AHA Centre | (as required) |

Source: JICA Study Team

### 7.2.3 Natural Disaster Risk Assessment and Formulation of BCP for Regional Industrial Clusters[20]

(1) Background

Flood disasters in 2011 had caused serious and historical damages to ASEAN countries. In particular, the flooding of the Chao Phraya River of Thailand has not only caused direct economic losses of USD 45.7 billion[21] to firms in industrial parks and clusters of Thailand, but also indirectly and considerably affected economies of other ASEAN member countries and Japan, who are closely linked through networks of supply chains.

As a result, the flood disaster forced industries engaged in electronics, automotive parts, machinery parts, and others to shut down, which adversely affected the worldwide production of related businesses such as automotive industries, for a long period. According to the Office

[20] This subject was presented by the Study Team to the representative from ten ASEAN countries at the workshop held on 11 June 2011 in Jakarta

[21] According to the estimation of the World Bank as of December 2011

of Insurance Commission, insured losses from the floods in Thailand 2011 were expected to be in excess of USD 10.8 billion[22], which would be further adjusted in the final loss figures. Consequently, they were forced to withdraw from the affected areas or revise their terms and conditions, causing investors/industries to be hesitant in continuing their activities in the affected areas.

From the experiences of the Chao Phraya River flood in 2011, it was reaffirmed that natural disasters will have severe and adverse impacts not only on humanitarian aspects but also on national and inter-regional nations, as well as worldwide economy. It has also been recognized that against such huge natural disasters, efforts by individual firm/factory will experience limited effects. Therefore, an approach where industrial park/cluster acting as one unit of economic body, will have to be taken into consideration for disaster management.

Under such circumstance, formulation of business continuity plan (BCP)[23] is indispensable for each regional industrial cluster based on scientific risk assessment to minimize economic losses/damages resulting from natural disasters.

(2) Purpose

a) To conduct natural disaster risk assessment for industrial clusters in the ASEAN region,
b) To formulate a BCP for the target industrial cluster based on risk assessment, and
c) To propose an ASEAN standard procedure for natural disaster risk assessment, and formulate business continuity plan for industrial clusters.

(3) Target Area for Research/Study

Industrial clusters in ASEAN member countries are to be nominated and selected through dialogues among relevant organizations.

(4) Contents/Outputs from Research/Study

The items for research and study are, but not limited to, the following shown in table below:

[22] As of December 2011: Office of Insurance Commission
[23] In a broad sense, it is called as "Incident Preparedness and Operational Continuity Management (IPOCM)"

**Table 7.2.4 Draft Work Items – Bi-lateral Cooperation**

| Phase 1 Natural Disaster Risk Assessment | Phase 2 Regional BCP |
|---|---|
| 1. Collect, organize analyze data of hazard, exposure, vulnerability, damage and others of identified natural disasters. Data collection of maps-information is also included.<br>2. Build a GIS database of natural disasters and socio-economic conditions.<br>3. Conduct hazard assessment and impact assessment of natural disasters;<br>(1) Identification of hazard, risk and thread of flood, earthquake/tsunami, storm and others,<br>(2) Estimation of direct and/or indirect economic damages/losses to industries and/or macro-economy,<br>(3) Development of hazard maps according to various scenarios of hazard identified, and<br>(4) Impact analysis<br>4. Assess impact on industries, supply chains and macro-economy.<br>5. Analyze and assess vulnerability and risk of facilities and/or properties susceptible to natural disasters. | 6. BCP formulation<br>(1) Prevention and mitigation programs<br>(2) Response management programs<br>(3) Emergency response management program<br>(4) Continuity management program<br>(5) Recovery management program<br>(6) Risk transfer<br>7. Implementation and operation<br>(1) Resources, roles, responsibility, and authority<br>(2) Building and embedding BCP in the organization's culture<br>(3) Competence, training, and awareness<br>(4) Communication and warning<br>(5) Operation control<br>8. Finance and administration<br>9. BCP performance assessment<br>(1) System evaluation<br>(2) Performance measurement and monitoring<br>(3) Testing and exercise<br>(4) Corrective and preventive action<br>(5) Maintenance<br>(6) Internal audits and self assessment<br>10. Management review<br>（Items 6～10: after ISO/PAS 22399, except 6-（5）added by the Study Team） |

Notes:

1) Indirect damages/losses (damages to industries and macro-economy) will have to be estimated from the viewpoint of ASEAN regional collaboration (Item 3. (2)), which necessitates a considerable period for comprehensive data collection and analysis.
2) Items 6 to 10 in Phase 2 defined as Regional BCP will be similar to comprehensive natural disaster management plan with a special emphasis on 'activity continuity'.
3) Accuracy of hazard maps and/or risk maps to be formulated will be subject to topographic maps (availability, scale and accuracy), accuracy of hazard analysis and others; those are largely dependent on volume of input from human resources and time. Accuracy of hazard maps will have therefore to be determined through an assessment of availability of resources to be input.
4) Items 7 -10 are standard items included in ISO procedures for sustaining the actual operation of the BCP.
5) Risk Transfer (6. (6)) is included by the Study Team in the plan is considered to be an essential alternative for risk management.

Source: JICA Study Team

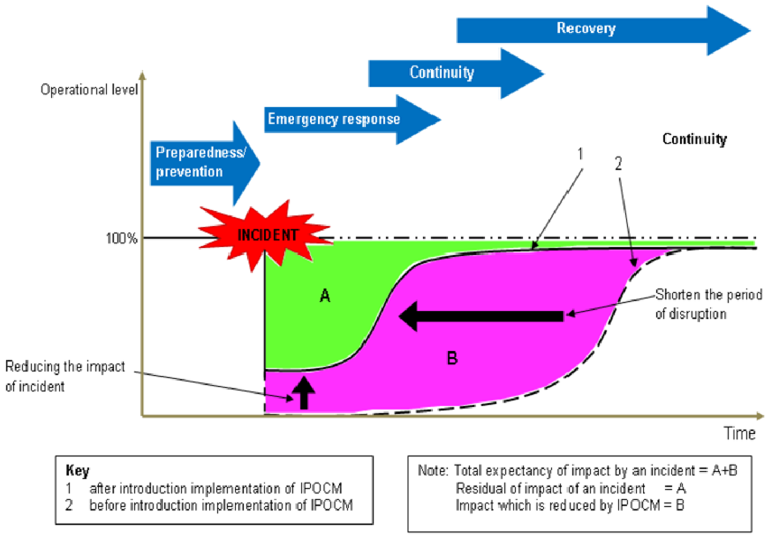
(5) Implementation Framework as ASEAN Regional Collaboration

Proposed implementation framework is shown in Table 7.2.5 below.

**Table 7.2.5 Implementation Framework (Draft)**

| ASEAN Regional Collaboration (Input from ASEAN) | Bi-lateral Cooperation (Input from state where target industrial cluster will locate) |
|---|---|
| ・ Coordination: AHA Centre<br>・ Panel of Experts: Disaster related-organizations/institution in ASEAN region:<br>➢ ASEAN Secretariat[note-1]<br>➢ Researching/academic institutions[Note-2] | ・ Counterpart agency: a government entity in charge of industrial clusters or the like,<br>・ Member of implementation committee: entity in charge of disaster management at national (such as NFP), and local levels where the target industrial clusters are located, and entities in charge of relevant disasters |
| Input from Japan | |
| ・ Funding Agency: Japan International Cooperation Agency (JICA)<br>・ Technical Advisors: Researching /academic institutions/agency in Japan[Note-3]<br>・ Implementation: Consultants | |
| Examples of organization/institutions<br>Note-1 : ASEAN Committee on Disaster Management（ACDM）<br>Committee on Science and Technology (COST)<br>Sub-committee on Meteorology and Geophysics<br>Note-2: ASEAN Earthquake Modeling Group (Nanyang University, Singapore），<br>BMKG(Indonesia), PHIVOLCS (**Philippines**)<br>Chulalongkorn University (Thailand)<br>Asia Institute of Technology (Thailand)<br>Southeast Asia Disaster Research Institute (SEADPRI-UKM) (Malaysia)<br>LIPI, Indonesia University, ITB, Gadhja Mada University (Jogjakarta), Syiah Kuala University（Aceh） (Indonesia)<br>Note-3: Tokyo University, Kyoto University, Tohoku University, I-Charm (Japan) | |

Source: JICA Study Team




Source: ISO/PAS 22399, Societal security – Guideline for incident preparedness and operational continuity management

**Figure 7.2.3 Concept of Disaster Preparedness and BCP**

### 7.2.4 Earthquake and Tsunami Disaster Management in Member Countries Facing South China Sea, Sulu Sea, and Celebes Sea[24]

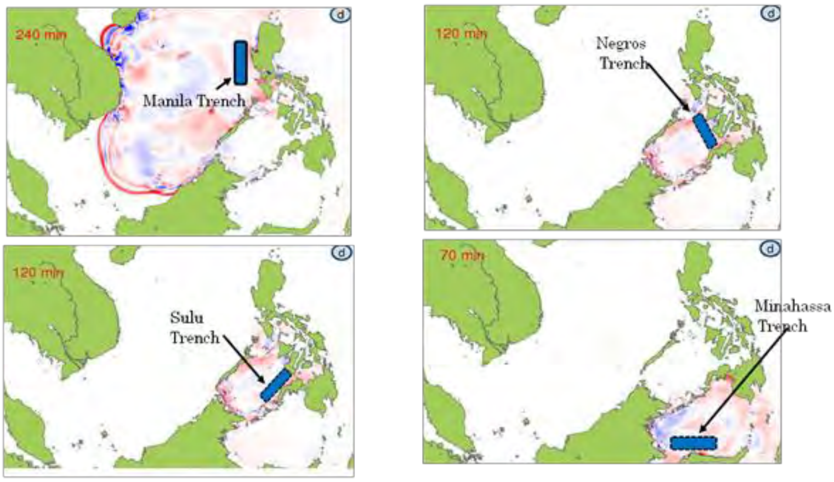
(1) Background

In the western offshore area of the Philippine Island, many trench structures are formed such as Manila Trench, Negros Trench, Sulu Trench, and Cotabato Trench. In the northern offshore area of Sulawesi Island in Indonesia, Minahasa Trench and Celebes Trench are distributed.

Out of these, USGS pointed out that there is a possibility of strong earthquake occurrence at M 8.5~9.0 in Manila Trench in near future. In case of occurrence of earthquake at this magnitude, not only an earthquake damage the **Philippines**, but also tsunami disaster will occur at the east central coast of Vietnam, Saba Sarawak area in Malaysia, and coastal area of Brunei. Other five trenches are also considered to be as possible sources of strong earthquakes accompanied with tsunamis.

Disaster management agencies of each country have already recognized the possibility of strong earthquake and tsunami originating in Manila Trench. The coastal area of the central Vietnam is beach resort areas having a world heritage. Similarly, the coastal area of Saba Sarawak in Malaysia is designated as a priority development area according to Saba Development Corridor Blue Print 2008~2025. At Seria coast in Brunei, petroleum and natural gas processing and exporting facilities are developed.

Once a strong earthquake and tsunami occur as pointed out by USGS and other researchers, such areas will possibly be severely affected. It is therefore recommended to implement (a) research on earthquake and tsunami and (b) formulation of disaster management plan in the western coast of the **Philippines**, central part of Vietnam coast, coastal area of Saba Sarawak, Brunei, and northern coast of Sulawesi Island in Indonesia.




Source: Tsunami simulation by MHD, Malaysia; locations of trenches added by JICA Study Team

**Figure 7.2.4 Techtronic Trenches in South China Sea, Sulu Sea and Celebes Sea**

[24] This issue was raised by the countries facing the seas; and was presented by the Study Team to the representatives from 10 ASEAN countries at the workshop held on 11 June 2011 in Jakarta.

(2) Purpose

a) To conduct research on earthquakes/tsunamis that could possibly occur in South China Sea, Sulu Sea, and Celebes Sea (ASEAN Collaboration),

b) To conduct impact/damage assessment through hazard mapping,

c) To formulate disaster management plans, including monitoring, early warning system and evacuation plan (➔ option only for bi-lateral cooperation),

(3) Target Area for Research/Study

a) The western coast of the **Philippines**,

b) The coastal area of the central part of Vietnam,

c) Coastal area of Saba Sarawak of Malaysia,

d) Coastal area of Brunei,

e) Northern coast of Sulawesi Island of Indonesia

(4) Research/Study Contents

Activities of collaborative research and study are proposed as follows.

**Table 7.2.6 Activities to be Conducted (Draft)**

| ASEAN Regional Collaboration (ASEAN Collaborative Research) | Development Study for Bi-Lateral Cooperation[Note-1] (Brunei, Indonesia, Malaysia, **Philippines**, Vietnam) |
|---|---|
| (1) To conduct collaborative research on earthquake/tsunami in South China Sea, Sulu Sea, and Celebes Sea.<br>(2) To develop earthquake/tsunami models for the target hypo-central region.<br>(3) To conduct computerized tsunami simulations with various assumptions.<br>(4) To propose a scenario of earthquake for each hypo-central region.<br>(5) To propose overall framework of earthquake and tsunami monitoring and warning system. | (1) To review the scenario of earthquake in view of selected target areas.<br>(2) To conduct tsunami simulation based on scenario earthquake with bathymetric information.<br>(3) To estimate damages/losses with reasonably accurate topographic maps, especially for industry-invested area.<br>(4) To evaluate impact on economic activities and supply chain.<br>(5) To propose monitoring system for earthquake and tsunami.<br>(6) To propose tsunami early warning system.<br>(7) To propose disaster management plan.<br>(8) To conduct training on disaster management in related countries. |

Source: JICA Study Team

Note-1: Development study in member countries may start after scenario earthquakes are proposed from the collaborative research.

(5) Implementation Framework

A similar framework as in the previous section is proposed in Table 7.2.5.

(6) Implementation Period

- ASEAN Regional Collaboration : 24 months
- Bi-lateral cooperation : 24 months

**Table 7.2.7 Implementation Framework (Draft)**

| ASEAN Regional Collaboration<br>(Input from ASEAN) | Bilateral Cooperation<br>(Input from state where target country) |
|---|---|
| ・ Coordination: AHA Centre<br>・ Panel of Experts: Disaster related-organizations/institution in ASEAN region:<br>➢ ASEAN Secretariat[note-1]<br>➢ Research/academic institutions[Note-2] | ・ Counterpart agency: entity in charge of disaster management at the national (NFP), and local levels where the target cities are located and entities in charge of relevant disasters |
| Input from Japan | |
| ・ Funding Agency: Japan International Cooperation Agency (JICA)[Note-4]<br>・ Technical Advisors: Research/academic institutions/agency in Japan[Note-3]<br>・ Implementation: Consultants | |
| Examples of organization/institutions<br>Note-1 : ASEAN Committee on Disaster Management（ACDM）<br>Committee on Science and Technology (COST)<br>Sub-committee on Meteorology and Geophysics<br>Note-2: ASEAN Earthquake Modeling Group (Nanyang Univ., Singapore）, BMKG(Indonesia), PHIVOLCS(Philippine))<br>Chulalongkorn University (Thailand), Asia Institute of Technology (Thailand),<br>Southeast Asia Disaster Research Institute (SEADPRI-UKM) (Malaysia)<br>LIPI, Indonesia Univ., ITB, etc. (Indonesia)<br>Note-3: Tokyo University, Kyoto University, Tohoku University, I-Charm (Japan)<br>Note-4: Funding by other sources within ASEAN member countries may be applicable. | |

Source: JICA Study Team

### 7.2.5 Development of ASEAN Disaster Management Information System (ADMIS)[25]

(1) Background

For effective disaster management, a comprehensive database system that stores vast variety of information, which are not only related to disasters but also to socio-economics. Thus, development of GIS based ASEAN Disaster Management Information System (ADMIS) is necessary to support the basic activity of AHA Centre as an information hub for disaster management in the ASEAN region.

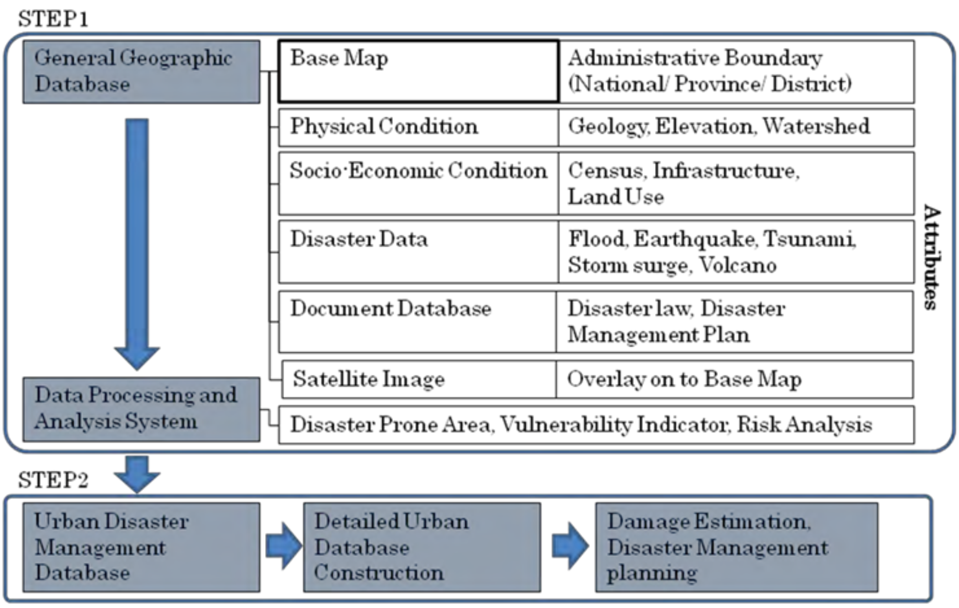
It is understood that the project for the development and deployment of Disaster Monitoring and Response System (DMRS) for the AHA Centre was launched in April 2012. It is expected that the system will offer early warning and decision support systems to be customized for the needs of AHA Centre and the ASEAN member countries. DMRS is considered to become much more powerful if linked with a comprehensive database that ADMIS can provide.

Thus, the present study recommends that the GIS based ADMIS be developed together with data set, which shall be collected as one component of the project.

(2) Concept of ADMIS Development

The concept of the proposed ADMIS is illustrated in the Figure 7.2.5

[25] This issue was briefly presented to the AHA Centre who was interested in the concept.




Source: JICA Study Team

**Figure 7.2.5 Concept of ADMIS**

ADMIS shall be developed in the following two steps.

1) The First Step of ADMIS Development

The first step consists of development of a general database, data collection and development of data analysis system

a) Development of a general database and data collection

In this step, general map data with scale of one to one million covering each ASEAN member country is created. Together with the creation of a base map, related natural and physical data, socio-economic data, infrastructure data, census data, and disaster data will be collected. Existing digital files of these geographic and statistical data will be utilized as much as possible to avoid duplicated investment.

Data collection items are indicated below as examples:

**Table 7.2.8 Example of Information to be Collected**

| | |
|---|---|
| a. | Administrative boundary such as national, provincial, district, etc., |
| b. | Census data such as population, |
| c. | Socio-economic statistics including income level, |
| d. | Existing land use, |
| e. | Physical conditions such as elevation, geology, fault line, and watershed boundary, |
| f. | Climatic data, |
| g. | Main road network, railway network, port location, airport location, urban center, |
| h. | River network, lakes, reservoirs, dam, |
| i. | Main hospitals related to disaster management, |
| j. | Satellite imageries, and |
| k. | Others. |

Source: JICA Study Team

Collected map data will be specifically manipulated to adjust its scale and legends, and finally integrated into a uniform projection system.

b) Development of data analysis system

Data processing and analysis system are among the important aspects, which will be developed for effective use of geographic database using the overlay technique, for example, the spatial analysis.

In addition to the development of data processing and analysis system, many numerical data will be analyzed and mapped to generate indicators to support decision making. General vulnerability indicators for example will be generated through the numerical data analysis, and mapped using the data processing and analysis system. These will result in general vulnerability maps. Thereafter, existing disaster prone areas will be combined with the general vulnerability maps to identify fundamentally problematic areas in the ASEAN region.

ADMIS will be linked with related database system or existing regional disaster management system such as flood risk analysis and earthquake disaster analysis.

2) The Second Step of ADMIS Development

The second step of ADMIS development will focus on detailed geographic database development for large or megacity disaster management system. Large topographic maps with scales such as 1:2,500 or 1:5,000 will be collected /generated in this system for the creation of a detailed database system. Similar information is listed in Table 7.2.8 although more detailed information shall be collected.

AHA Centre will conduct the necessary systems operation and maintenance through effective use of GIS-based ADMIS for disaster management.

(3) Issues to be solved for ADMIS Development

In order to develop ADMIS, the member countries shall agree on map data sharing system including the scale, projection system and accuracy, data collection and dissemination methodology in disaster management field.

Specific cooperation with AHA Centre will be needed to make a general agreement for ADMIS development, similar to the cooperation being conducted for the development of ASEAN Guideline on flood risk assessment.

(4) Implementation Framework

The study proposes the following framework for implementation. The AHA Centre is expected to act as the coordinator for the project.

**Table 7.2.9 Activities to be conducted**

| ASEAN Regional Collaboration | In Each Member State |
|---|---|
| ● Creation of ADMIS | ● Collection of information for the database system. The information to be collected will also be provided to each member state for the creation of their own database system, which may be implemented in the next stage. |

Source: JICA Study Team

**Table 7.2.10 Implementation Framework**

| ASEAN Regional Collaboration | In Each Member State |
|---|---|
| ● Counterpart/coordination: AHA Centre<br>● Implementation: Consultants<br>● Cooperation: PDC[*1] | ● Collaboration: the ASEAN member countries |
| ● Funding agency: Japan International Cooperation Agency (JICA)<br>Note *1: Pacific disaster center implemented DMRS project | |

Source: JICA Study Team

(5) Implementation Period

1. Preparation : 6 months
2. Data collection in the ASEAN member countries : 6 months
3. Development of database, creation of analysis system : 9 months

Total : 21 months

### 7.2.6 Disaster Information System in Major Cities of ASEAN Region with ASEAN Common Data Format[26]

(1) Background

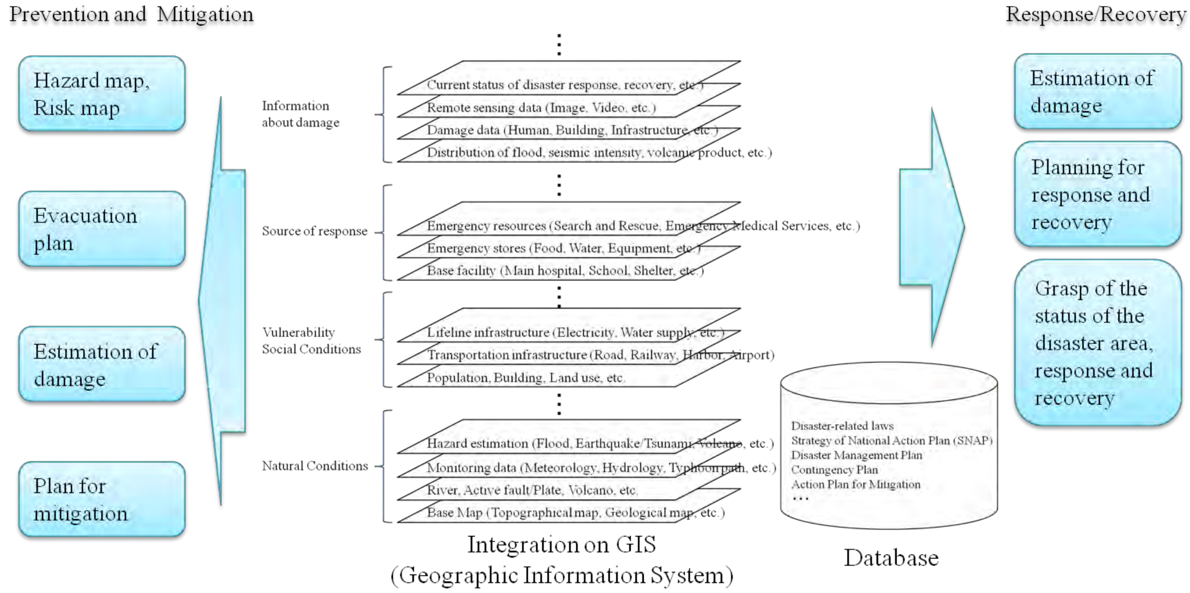
In order to materialize the disaster risk reduction, conducting disaster risk assessment should be a prerequisite condition. This will require various sets of information regarding past disaster records, socio-economic conditions, natural, and physical constitutions, and so on. Therefore, DMIS should be introduced to integrate such valuable information. The DMIS will also be utilized for formulation of disaster management plan, as a decision making tool when disasters occur as well as data accumulation of disaster related information. Though little autonomy of ASEAN countries has introduced such DMIS at present, it is expected for them to introduce soon the DMIS for disaster risk management.

The AHA Centre, as the coordinating body of ASEAN disaster management, should be linked to the DMIS of ASEAN member countries for smooth coordination with shared information. For this purpose, data type, accuracy, format, and so on of essential information will have to be standardized among the ASEAN member countries.

This proposed program will provide standard format of data, which will be stored as part of the database in DMIS of the ASEAN member countries. It will also build the DMIS for

[26] This issue is proposed by the JICA Study Team in this report.

targeted local autonomies such as megacities with information to be collected in the program, in accordance with the specifications to be proposed by this program.




Source: JICA Study Team

**Figure 7.2.6 Conceptual Image of DMIS**

(2) Alignment with the ASEAN's Effort in Disaster Management

The "Risk Assessment, Early Warning and Monitoring" is one of the four strategic components of the AADMER Work Program 2010-2015, proposing "GIS-based Disaster Information-Sharing Platform for Early Warning" as one of its flagship projects. Accordingly, the Daft AHA Centre Strategic Work Plan includes "monitoring for disaster alert and assessing potential disaster situation" as Function 2; and "ASEAN Strategy on Disaster Risk Assessment (the draft roadmap for risk assessment)" selected "ASEAN-wide Disaster Risk Assessment" as the subject in the executive summary.

As such, this program proposed aligned with the ASEAN efforts in disaster management

(3) Activities Proposed

- Propose ASEAN common data format for DMIS.
- Build disaster management systems for targeted cities that need special attention to multi-hazard disasters. The systems will also be equipped with data analysis system.
- Collect information necessary and store them to the disaster management systems built by this program. Consequently, the system will be a proto-type of disaster management systems to be introduced to other cities of the ASEAN member countries.

(4) Implementation Framework

- Targeted institutions/organizations:

**Table 7.2.11 Targeted Institutions/ Organizations**

| Outputs | Target institutions/organization |
|---|---|
| Proposing ASEAN common data format of disaster management systems | ASEAN member countries through AHA Centre |
| Building DMIS with necessary data collection | Mega cities to be proposed |

Source: JICA Study Team

- Coordination: AHA Centre
- Implementation: Consultants
- Funding Agency: JICA

(5) Period Required

- Formulation ASEAN Common data format : 6 months
- Data collection in targeted cities : 6 months
- Database design, data input and data analysis system : 9 months

### 7.2.7 Others Subjects for Collaborative Research

1) Research community based disaster, management with consideration of national/local cultures of ASEAN regions
2) Case studies of community disaster management exercised in the Great East Japan Earthquake and their applicability to the ASEAN region.
3) Research on psychology and reactions in cases of huge disaster, and its applicability to disaster management.
4) Research on effectiveness of mangrove forest against tsunami – case studies.
5) Research on effective promotion of evacuation exercise in ASEAN Countries
6) Research on disaster-proof infrastructure with optimized cost and benefits.
7) Research on comprehensive disaster risk assessment of megacities in ASEAN countries.
8) Research on worst case scenario simulation for disaster management in ASEAN region, leaning from the Great East Japan Earthquake.